

THE Chemical Age

VOL. LXXIII

24 DECEMBER 1955

No. 1902

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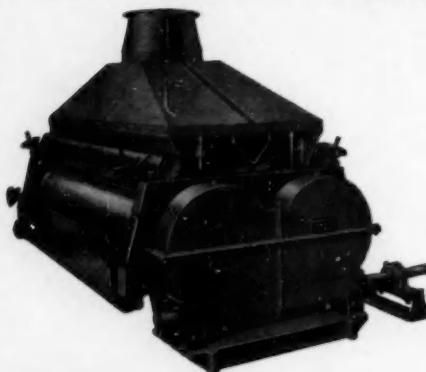


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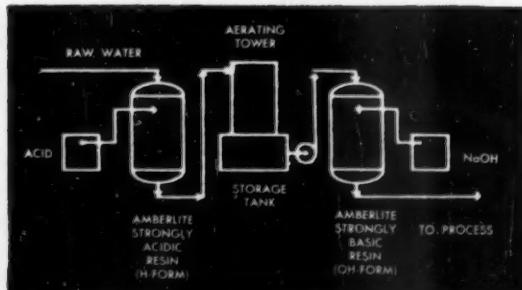
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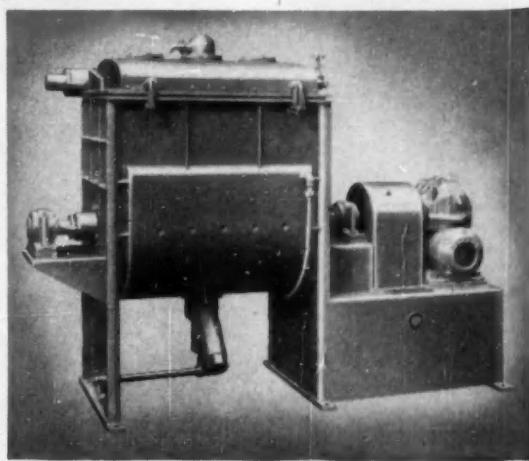
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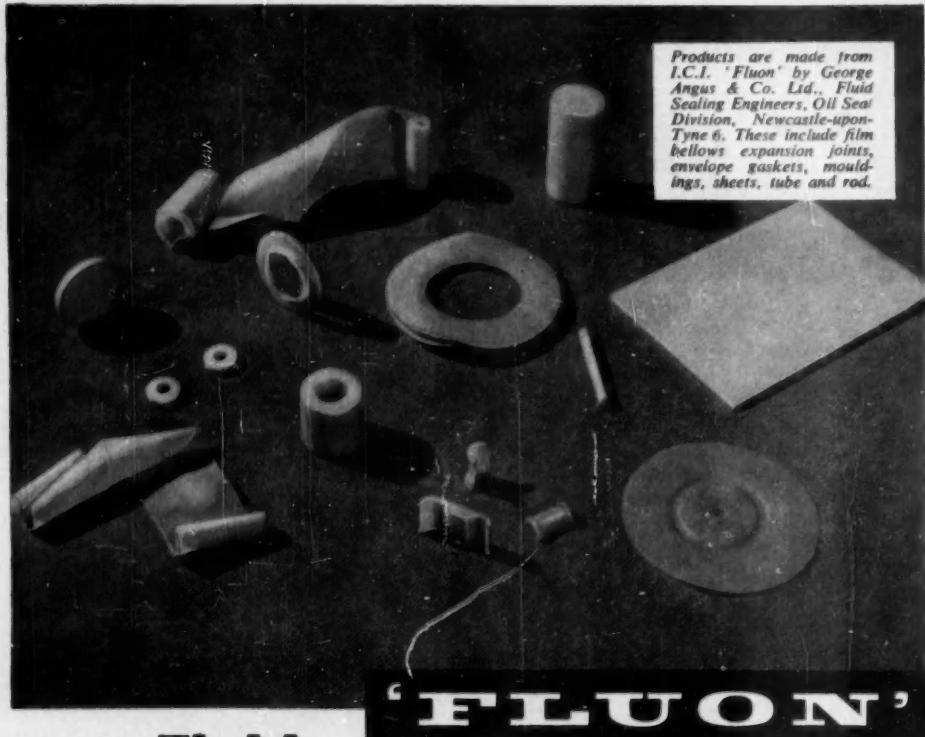
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Publisher & Manager: A. Walsby

Director: N. B. Livingstone Wallace

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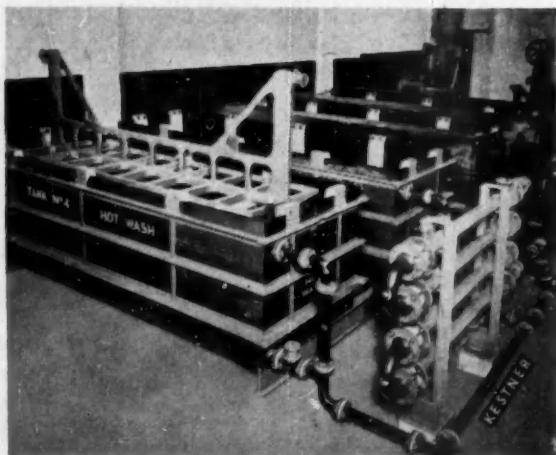
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The Supply of Boffins

FOR some years we, in common with other technical journals and most scientific societies, have drawn frequent attention to the inadequacy of scientific educational facilities. The scientist shortage that now exists is probably little more serious than the shortage of all types of highly skilled workers; if there is generally a state of full employment, there is for all special skills a state of over-employment. For this there are no immediate cures; time and training alone can create skill. What we must make and do with today was determined by the educational facilities of 10, 20, and 30 years ago. But every phase of production, every sector of manufacture, yearly becomes more scientific in nature; so does the national defence system; so does the State's administration in many of its major responsibilities. In five or 10 years' time the demand for scientists will be far greater than the demand today, and so it must go on, an inevitable process of accelerating expansion. The so-called back room has become the entire ground floor, or as nearly so as makes no difference.

Such is the potency of personality in politics that the recent warning from Sir Winston Churchill has attracted more attention than all the former warnings from scientists and scientific organizations. But even Lord Cherwell had spoken forcibly about our backwardness in expanding scientific education facilities during the time that Sir Winston was in active charge of the country's Government; the addition of Sir Winston's name to the list of pace-makers is valuable enough, but how much more might have been achieved already had he become

alarmed about this national weakness a few years sooner!

According to an article by the well-known scientific journalist, Ritchie Calder (*News Chronicle*, 12 December 1955), Sir Winston's sudden venture into this subject was prompted (a) by his instinct for sensing danger, and (b) by the disquiet reported by British atomic scientists who have recently visited Russia. It is suggested that our scientist production effort is 'trivial' when compared with that of the USSR, not in atomic science and technology alone, but in the whole field. This sort of thing must always be somewhat conjectural for no one in his senses imagines that reports on such vital matters are made openly available. However, several articles and commentaries in the US scientific press in the last two or three years, and particularly in recent months, have made closely similar points about the Soviet scientific effort. This may be difficult to align with the not infrequent reports that in many ways Russian developments today are more comparable with the earlier twentieth century in Western Europe than with the 1940s or 1950s. But does the contemporary comparison count? Countries whose industries are long established can live for an appreciable time on their momentum and fat, but the future belongs to those who are making the biggest investments in it. It may well prove ultimately that the crucial testing point for capitalism and anti-capitalism is the extent to which science has been supported, and in that sense science is a non-political, neutral force.

It is easy to believe that Britain stands

alone among the powers of the West in her deficiency of scientific training arrangements. More than most countries, we indulge in open self-criticism; it is one of our strengths that we do, but it is also a weakness if we suppose that expression of criticism is a substitute for action. The position is not much better in the United States if figures are judged on a *per capita* population basis, and it may indeed be worse through the emphasis that the US has long placed upon applied research and technology, giving her a pronounced weakness in fundamental science. There are as many home critics of the scientific effort in America as there are here, and in 1954 and 1955 they have become quite as vocal. There, as here, the Achilles Heel is the science-teaching effort in the schools—at the beginning, in the very foundation.

A great deal has been said about this problem of science teacher shortage, but in our view there is only one obvious comment—we shall not fill the gaps, or even begin to, until the graduate in science can be sure that a career in teaching involves neither economic loss nor decline in potential status. All the wishful idealism about vocational calls and none of the emergency realism of part-time teachers from industry can alter the basic fact that what teaching offers to any qualified scientist is grossly insufficient. The pay, even with maximum hopes, is far too poor; and there is little or no compensation by way of professional status. If it is true that things are much better in Russia, is it surprising truth? There economic differentiations between the different tasks of graduate level work are smaller, and the status of the teacher is high both socially and professionally. The same problem is not occurring because the factors that create it are non-existent.

The situation could be transformed overnight—at any rate so far as the future in 1965 and 1975 is concerned. The scale for science teachers' pay could be raised until it was reasonably in line with salaries and moderate prospects for scientists in industry, other government service, research, and universities. In itself this would not be a costly solution;

and it would be far less costly than the future effects of our current inefficiency. But what would happen at once? All teachers of all subjects would demand the same rate of pay and the real cost to the country would be more than quadrupled. Many of those who teach non-scientific subjects would become entitled to an earning rate much in excess of their alternative opportunities in other walks of life. The teaching profession is more collectively organized than most, as is shown by the present *furore* over the increase in personal contributions to superannuation. If there is so much resentment about the correction of gross actuarial unsoundness in a superannuation scheme, how much more would there be over differential pay for teaching certain subjects? Let it be recognized that the outlook for the simplest and obvious solution to science teacher shortage is poor, very poor or far more costly than it need be.

Difficult and obstinate problems are usually solved under the pressure of events. The first high-pressure event is now a fact—it has been recognized that Russia is getting ahead in producing young scientists. Teaching, sooner rather than later, must be made more attractive for graduates in science, and obstacles whose importance in the scales is less than that of national need will have to be pushed aside. The possible disagreements of a profession cannot constrict the future of the country. The plain and hard truth, whether unpalatable or not, is that it is now and irrevocably a scientific age, and in a scientific age knowledge of the sciences is of greater economic importance than knowledge of most other subjects. We either recognize this or we become none too gradually a tenth-rate country, possibly well cultured but certainly starving.

It has been one of the more welcome events of late 1955 to see this main-arterial problem thrust well forward into public focus. Will we be able to say that 1956 brings firm action instead of wishful tinkering treatments and plans that offer no more than trivial palliatives? It is not enough to place the burden on the Minister of Education—it is a long-term Cabinet-level problem.

Notes & Comments

Chemicals in Yugoslavia

GERMANY'S central position enables her to observe the chemical affairs of other European countries with exceptional detail, and there was a remarkably well informed survey of Yugoslavia's post-war chemical advancement in a recent issue of *Chemische Industrie* (English Edition, 1955, 2, 45.) Although expansion has never achieved its state-planned and much encouraged rate, over-all chemical output by 1954 had an index of about 220 (volume) compared with 1939 at 100. The most marked jump in a year, since the war, took place between 1953 and 1954. If the old saying about sulphuric acid is still a key truth, this doubling of the pre-war level is something of an under-estimate of progress; for sulphuric acid output has been quadrupled, rising from under 15,000 tons in 1939 to almost 60,000 in 1954. However, even 60,000 tons is small for a country of Yugoslavia's size. This 60,000 tons is mainly manufactured at three works. At one it is used entirely for superphosphate production; the other two send all their acid to coal chemical

works. Remaining acid needs of Yugoslavia are met by imports. An import requirement of some 50,000 tons is estimated. All these figures would have to be much greater if Yugoslavian agriculture were not so backward; the low fertilizer usage rate undoubtedly obviates a much more serious acid supply problem. Pyrites is the main raw material used for acid. Yet one of Yugoslavia's main metallurgical ventures, copper production, could, if copper smelting gas wastes were used, probably add 300,000 tons of acid to the total annual production. At the same time, production of copper sulphate has been falling since 1953 for lack of acid to make it!

Some Ups & Downs

FIVE new heavy chemical works have been erected in the past 10 years; three new plants for making dyestuffs and synthetic resins (including pvc); and nine new pharmaceutical or toilet product works. There is exceptional emphasis upon this last type of chemical manufacture because Yugoslavia has a wealth of medicinal plants and essential-

The staff of *The Chemical Age*
wish all readers a very happy
Christmas and prosperity in the
New Year

oil producing crops. However, one of Yugoslavia's most important 'natural' exports—tannin—no longer brings her as much exchange. Her home demand is much greater and there is less to export; but in any case competition between leather and leather substitutes has weakened her export market. A pre-war annual tonnage has fallen from more than 14,000 tons to 4,750 tons; the decline is not as much as these tonnage figures imply; the tannin content of today's exported products is considerably higher, and in terms of tannin export volume has only been halved. Calcium carbide production has also declined. Severe war damage to the plants was followed by acute power shortages, and the pre-war level of output has never been regained. Exports today run at about 10,000 tons a year where before the war they were usually as much as 20,000 tons. Soap production is well above 1939 levels, 25,000 tons per year as against 12,000. A more impressive expansion might well have been expected of Yugoslavia's chemical industry, but in fairness it must be admitted that the help she has received by way of equipment and 'know-how' has been much less than that received by many other European countries.

Austrian Prospects

IT was found that too little was known of the British chemical plant industry and considerable interest was expressed on learning of its achievements and capabilities... This extract comes from a new FBI Report, 'Mission to Austria, 1955' (see p. 1371). Section III in this report deals entirely with the Austrian chemical industry and the export sales openings for manufacturers of plant and was written by Dr. Hoblyn of the BCPMA—a man fully qualified to make a quick and accurate assessment. Austria's chemical industry has jumped into new prominence and become her third largest industry. This has been readily appreciated by German firms but British attention has not greatly increased over its former 'not-much-for-us-here' attitude. Production of heavy chemicals and fertilizers is the main task of the Austrian industry and the fertilizer export trade may well be steadily

expansive. Calcium carbide is manufactured, and some acetylene from this product is used to make chlorinated hydrocarbon solvents. Three works produce chlorine and caustic soda; some 50,000 tons a year of the latter are produced. Tar products (75,000 tons) are made from gas and coke oven tar. The pharmaceutical industry has expanded so that Austrian imports in this field have been reduced from 80 per cent pre-war to a current 20 per cent. Plastics and rayon production have developed steadily; a petrochemicals industry seems likely to be started in the near future. Paint production meets almost all home needs.

Equipment Needed

EQUIPMENT is not in the usual apple-pie state of a progressive and expanding chemical industry. Much of it was over-worked during the Russian occupation and little modernization or replacement has been possible since. Equipment is urgently needed in many works with opportunities to expand production and sales. Traditionally, Austria's chemical factories have been equipped by Germany—identical language, weights and measures systems, and proximity have all been potent influences. To compete with this natural tendency, British firms must send literature and letters in German, must use the metric system, and must quote prices on the basis of 'free at Austrian frontier'.

Worthwhile Market

EXPORT business with Austria can be done and it is worth doing. British sales rose by 16 per cent in 1954, but German, Italian, and Swiss sales rose by 69, 48, and 50 per cent respectively. One factor in this opportunity for more inter-European trade is the falling-off of US direct aid, now no longer as essential for Austrian recovery. Mainly as a result of this reduction in aid, US trade figures fell by 35 per cent in 1954. The FBI Report, which covers all types of industry, is being circulated widely. It is to be hoped that it will be studied thoroughly by British chemical plant firms and also by British chemical companies.

Manufacturing Capacity Extended

BOE's Building Programme Near Completion

AN important addition to the works of British Oxygen Engineering Ltd., Edmonton, London N18, a subsidiary of The British Oxygen Company, will be completed by January 1956. This extension will complete a building programme undertaken by the company in 1954, and will result in the streamlining of manufacturing programmes for the company's products.

A feature of BOE's building programme is that the design and supervision of construction is all carried out by the company's own architects and civil engineers.

A new workshop is being built which is 320 ft. long and will consist of three bays, the centre being 75 ft. wide with a height of 60 ft. to the eaves, being flanked by two lower bays each 60 ft. wide and 32 ft. high to the eaves. A further 60 ft. bay will be added at a later date.

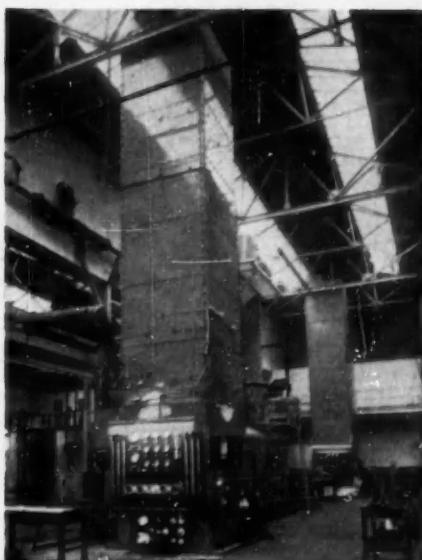
The centre bay of the new building will be used for the assembly of large air separation units and equipment for tonnage oxygen plants. Light work will be carried out in the galleries on both sides of the high bay and non-ferrous components will be fabricated and pressure tested in one of the smaller bays. The other small bay is reserved for the manufacture of storage tanks and steel fabrication. A separate section is reserved for the testing of prototype plants which the company has to develop continuously.

Another shop, in which equipment for the

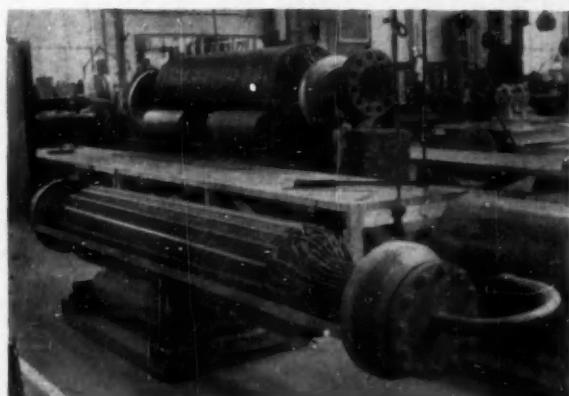
storage and distribution of liquefied gases in customers' works is constructed, has already been extended.

These extensions are necessitated by a considerable increase in demand for the company's products and will at the same time facilitate streamlining of construction work.

British Oxygen Engineering specializes in low temperature engineering and particularly



Above: Air separation units undergoing final tests at the Edmonton works of BOE



Left: A stage in the manufacture of heat exchangers showing the intricate arrangement of copper tubing involved

in the manufacture of plant and equipment for the separation of gases, especially air at low temperature. The construction materials used are mainly copper and copper alloys, aluminium and stainless steel, and the equipment required for mass and heat transfer, either between gases and liquids or between liquids and liquids, is of high efficiency and constitutes, in spite of the sometimes very large dimensions, work having a very high degree of precision.

The space which now becomes available in the present works will be used for the assembly of small air separation units and will provide extended facilities for the manufacture of small gas compressors, pumps for liquefied gases etc.

Royal Visit

Princess Margaret at Amersham

IN the course of a visit to the Radio Chemical Centre, Amersham, Bucks, on 9 December, Her Royal Highness Princess Margaret was shown an exhibition of industrial instruments which employ the products of the centre. These included a *beta* ray thickness gauge for the continuous measurement of thin sheets of material, a machine for detecting empty packages on a production line, equipment for the elimination of troubles due to static electricity in the textile industry, an automatic fire detector, and equipment for the testing of welds and castings by radiography.

The Princess saw equipment which is used for the production of the more important radioactive isotopes, such as radio-iodine, radio-phosphorus, radio-gold and radio-carbon. The use of radioactive carbon as a tracer in biological research was explained by Dr. J. R. Catch of the organic department.

The centre's arrangements for dealing with orders from all over the world were also shown to the Princess. The annual rate of deliveries has increased from about 2,000 in 1950 to about 12,000 in 1955.

The several hundred products offered by the centre are described in the general catalogue 'Radioactive Materials' which is available in an abridged form prior to the publication of a revised version of the full catalogue.

Amersham is one of the smaller establishments of the Atomic Energy Authority, and began in 1940 as a private company

producing radium and self luminous paints during the war. It was taken over by the Ministry of Supply in 1946 to form the nucleus of the Radiochemical Centre which was created officially on 1 November of that year. In 1950 the Centre became part of the Atomic Energy Research Establishment under the general directorship of Sir John Cockcroft, and this arrangement now continues under the Atomic Energy Authority.

The present staff is less than 200 of which about 50 are professional scientists and others.

Plastics Education

£3,500 Grants to Students

GRANTS totalling £3,500 were made to students up to the end of November 1955, it is reported by the trustees of the Plastics Industry Education Fund.

Twelve students from the plastics industry taking science courses at universities or technical colleges have been given monetary awards and others are being lent books. Of the students who completed their courses in 1955, four obtained honours degrees and three pass degrees in science subjects. Those not continuing their studies or on National Service have returned to the plastics industry.

At the Borough Polytechnic, London, seven more boys, after leaving school last September, started the full-time course for the diploma of the Plastics Institute with the help of bursaries from the fund. Of the bursary holders who completed the diploma course last July, six are employed in the plastics industry and two are continuing their studies for the Associateship of the Plastics Institute.

Six students at the Birmingham College of Technology holding scholarships from the fund are in the second year of the course leading to the Associateship of the Plastics Institute. It is also hoped during 1955 to help, by scholarships, boys taking the 'sandwich' course in plastics technology at the college.

The trustees have offered a research studentship in plastics technology of £300 a year at Acton Technical College, and applications for this have been invited.

Further progress is reported by the Plastics Institute in the publication of monographs which are financed by the Trustees.

Indian Newsletter

FROM OUR OWN CORRESPONDENT

AT the 15th annual general meeting of the Indian Chemical Manufacturers' Association held at New Delhi, the President (Mr. Madanlal H. Vakil) said that the tempo of production had increased during the current year. The chemical manufacturers in the country had now undertaken to produce stabilized bleaching powder, acetic acid, caustic soda flakes, sodium hydrosulphite, ammonium chloride and benzene hexachloride. The Association, he said, welcomed Government proposals to increase the targets for chemicals in the second five year plan. However, at the meeting, dissatisfaction was expressed with the Government's restrictive import policy for essential chemicals such as caustic soda and sodium bicarbonate for which only two firms had been allowed imports and distribution facilities. Regarding other chemicals where indigenous production was well below the requirements of the country, foreign exchange should be allotted for their imports, it was emphasized.

The Union Minister for Railways, who inaugurated the meeting, expressed the hope that the chemical industry would come in for a share of the increased transport facilities which the railways would provide in the second plan period. It may be added that a committee is currently inquiring into the railway freight structure in the country. Mr. Charat Ram was elected president of the Association for 1955-56.

The president of the Indian Non-Ferrous Metals Manufacturers' Association, at its eighth annual general meeting in Bombay recently, pointed out that competition from the Government controlled ordnance factories was having an adverse effect on the industry, which was faced with a surplus position. He urged for a fair pricing of the products from Government factories, which were selling at rates lower in some cases even than the cost of the raw materials. The need for continued protection to the non-ferrous metals industry was stressed as was also the need for organizing the industry with regard to quality control and standardization of products. The Minister for Finance and Industries of the Govern-

ment of Bombay in inaugurating the meeting suggested that the industry might concentrate on developing the use of aluminium on an extensive scale while reserving copper for the most essential needs of the country. Mr. S. C. Jain was elected as president for the next session.

According to the Chief Minister of the Travancore-Cochin Government, the State Government has ordered an investigation to ascertain the uranium content of mineral sands found at a spot near Trivandrum. It was stated that though it has been proved that the sands contained uranium, the percentage of the strategic element present was not known. It may be remarked that the well known beach sands of Travancore contain monazite, which carries 0.35 per cent of uranium oxide. The extraction of uranium from monazite has been worked out in India and is currently engaging the attention of the Indian Atomic Energy Commission in the processing of monazite. Some interesting aspects connected with the early discovery of uranium minerals in India, which were published recently in a section of the Press, have attracted considerable attention. At a recent meeting held under the auspices of the Electrochemical Society, India Section, and the Indian Institute of Metals, a survey of the beach sand mining industry in the Travancore-Cochin State was presented. It was pointed out that about 50,000,000 tons of ilmenite alone could be worked from the deposits which were only being scratched on the surface at present. The need for recovering all economic minerals from the beach deposits as also that of tackling some fundamental chemical and mineralogical problems was stressed.

The Prime Minister of India told the Indian Parliament that heavy water would be used as a moderator in atomic energy work in India. Meanwhile it has been reported that the construction of the proposed heavy water-cum-fertilizer factory at Nangal would begin in 1957. The project, which is estimated to cost Rs.250,000,000 (£18,750,000), is expected to go into production in 1960 and produce seven tons of

heavy water per day, 500 tons of oxygen and about 1,000 tons of fertilizer. It is also learnt that the Government of India has under active consideration plans to set up a Rs.100,000,000 (£7,500,000) fertilizer factory at Trombay, near Bombay. The available waste gases from the oil refineries, which are being burnt now, will be used. The Shell Petroleum Company of London is understood to have submitted proposals for the establishment of a nitrogenous fertilizer factory as a private enterprise.

The presence of valuable limestone deposits in the 1,500 ft. high Someshwar range of hills, covering an area of 364 square miles has been reported by the Chief Mining Officer of the Government of Bihar. Mineral oil has also been located in the area and the State Government is to seek the assistance of the Government of India for further prospecting work. An excellent find of galena has been located in the Bellary District of Mysore State and massive specimens of nearly one cubic ft. have been taken out. The potentialities of the deposit are to be carefully assessed in view of the scarcity of lead minerals in India. The State Government of Mysore is in touch with the Government of India, on the matter of suitably amending the mineral concessions rules framed under the Mining Act, to remove some lacunae observed in their working.

The Government of India has set up a panel of experts to draw up programmes for the development of paper and pulp industries in India. The panel will assess the requirements of different varieties of paper examine the available raw materials and recommend measures for the manufacture of paper and also rayon. Two German experts are at present in India to advise the Government in this regard. Meanwhile, the Government of Madras is currently examining a proposal to start a paper factory at Mettupalayam in the Nilgiris, with a capacity of 50 tons of writing paper per day utilizing wattle, eucalyptus and bamboos. The scheme is estimated to cost initially Rs. 31,200,000 (£2,340,000).

The importance of utilizing better and efficient methods of extraction of oils from oil seeds and oil cakes and the necessity to start a laboratory to conduct research in this and allied fields were mentioned as deserved

ing high priority by the president of the Central Organization for Oil Industry and Trade at a symposium in Bombay. The extraction of oil by modern methods from rice bran, tobacco seed and other minor products was also urged.

Orders for cranes and such heavy equipment have been placed with Yugoslavia for the Sindri Fertilizer factory among other State owned concerns. The possibilities of increasing economic and trade relations between the two countries were outlined by a representative of the Federal Chamber of Foreign Trade of Yugoslavia recently at New Delhi.

In a symposium on Essential Oils at Dehra Dun several technical papers on the indigenous resources of essential oils in India, extraction of the valuable constituents by differing processes and the chemistry of the compounds were presented and discussed. The Council of Scientific and Industrial Research is considering proposals for the creation of an organization for the exploitation of various types of essential oils in India.

Hydraulics Sales Company

TWO old-established companies in the hydraulic engineering field have announced the formation of a joint sales and service company. The two companies concerned are Fawcett, Preston & Co. Ltd. of Bromborough and Finney Presses Ltd. of Birmingham and the new company will be known as Fawcett-Finney Ltd.

The head office and Midland Region sales office of the new company is at 27 Berkeley Street, Birmingham, and branch offices have been established at 60 Buckingham Palace Road, London SW1, Mayfield Park South, Fishponds, Bristol, and Bromborough, Cheshire.

Both Fawcett, Preston & Co. Ltd. and Finney Presses Ltd. plan to develop existing facilities at Birmingham and Bromborough for the design and production of special purpose plant for the engineering, shipbuilding, plastics, rubber and chemical trades; and the establishment of the new sales co-ordinating company. Fawcett-Finney Ltd., has been formulated to provide a closely co-ordinated sales organization to handle this aspect of the business.

Chemicals by Oxidation of Paraffins

by PETER W. SHERWOOD

OXYGENATED chemicals constitute to-day some 70-75 per cent of the petrochemical industry's entire output in aliphatic chemicals, if pure hydrocarbons (such as butadiene, polythene etc.) are excluded from consideration.

In the production of these oxygenated aliphatics, partial oxidation processes play a leading role. Starting with olefines and air, such processes may be highly specific, leading to ethylene oxide, acrolein etc. On the other hand commercial processes for the partial combustion of paraffinic hydrocarbons lead to a complex mixture of oxygenated derivatives, many of which are marketable.

This non-specificity of paraffin oxidation processes has proved a hindrance to their wide acceptance. Yet there is much attraction in the direct upgrading of inexpensive light paraffins to oxygenated chemicals. The incentive has proved sufficient for the development of direct oxidation processes which are fully competitive with more conventional routes to the same petrochemicals.

Propane & Butane

Among paraffins of low molecular weight, only propane and butane are to-day subjected to partial oxidation on a large scale. With two historical exceptions, oxidative conversion of methane and ethane has not become commercially successful. (We are not here concerned with conversion of methane to hydrogen and carbon monoxide, which is practised on a very large scale).

Pentanes and higher hydrocarbons have too high a value as fuel to permit their economic utilization as raw material in chemicals manufactured by low-yield oxidation processes.

Partial oxidation becomes once again interesting in the C_6 - C_{22} range of paraffins. Here liquid-phase processes have been employed commercially to produce fatty acids.

Several manufacturers are engaged in the partial oxidation of propane-butane mixtures. The pioneer installation of Cities Service Company has been in operation at Tallant, Oklahoma, since the late 1920s. Its original operations involved partial combustion of natural gas. However, since 1953-4,

this plant has been converted to a butanes feed.

The biggest operator in the field is Celanese Corporation, with vapour-phase oxidation plants located at Bishop, Texas, and Edmonton, Canada, respectively. This company also operates a liquid-phase butane oxidation process at Pampa, Texas.

In 1954, Warren Petroleum Company joined the ranks of firms engaged in partial oxidation of C_6 - C_8 paraffins. Its plant at Conroe, Texas, uses purified oxygen rather than air (1). This approach was also taken by McCarthy Chemical Co. to the oxidation of a C_6 - C_8 stream contained in low concentration (five per cent) in natural gas. Its plant, now defunct, was operated at Winnie, Texas.

A plethora of marketable derivatives is formed in these LPG oxidation processes. The important ones, in order of volume, are acetaldehyde, formaldehyde, methanol, acetone, *n*-propanol, and butyl alcohol. All of these are available competitively from alternate, less direct, manufacturing processes and direct oxidation accounts for only 10-20 per cent of the total supply by its products. *N*-propanol occupies a special position in that oxidation of paraffins provides the lion's share of the supply. The alternate source to-day is hydrogenation of propylene oxide.

The non-specificity of commercial paraffin oxidation makes the economics of these processes dependent on the market situation for fully five to eight principal products. The outlook for several of these oxygenated chemicals is currently in a state of flux due to recent development of new outlets and of new competitive manufacturing processes. Brief consideration of the market situation for the principal products of propane-butane oxidation will here be taken up in alphabetical order.

1. Acetaldehyde

On a dry basis, the production volume of this compound exceeds that of all other aldehydes. However, only a small portion enters trade channels as such. Of the estimated US output of 700,000,000 lb. in 1954, sales were reported at only 31,500,000 lb.

Acetaldehyde serves almost solely as intermediate in chemical synthesis. The lion's share goes to acetic acid and its anhydride and to *n*-butyl alcohol (via crotonaldehyde). Here is one estimate (2) of the end use distribution pattern for acetaldehyde:—

Derivative	Million lb. acetaldehyde
Acetic acid	330
<i>n</i> -butyl alcohol	200
Acetic anhydride	85
2-ethyl hexanol and other aldo products	50
Pentaerythritol	25
Pyridines, chloral, misc.	10

The main market, acetic anhydride, has fallen on hard days. Production (from all sources) has decreased from 976,000,000 lb. in 1951 to 690,600,000 lb. in 1954, and a parallel movement has necessarily occurred in acetic acid manufacture. The reason is the decline in demand for cellulose acetate which accounts for some 95 per cent of acetic anhydride consumption.

Somewhat brighter is the picture for *n*-butanol which has risen from 117,000,000 lb. in 1952 to 194,400,000 lb. in 1954. But this derivative must cope with effective competition from other solvents in the slow-growing nitrocellulose lacquer industry, its main outlet. The long-term outlook for *n*-butanol is therefore also quite limited. This alcohol is also a direct product of butane oxidation.

Oxidation derived octyl alcohols offer effective competition to 2-ethyl hexanol in its main market, the manufacture of phthalate plasticizers.

Brightest spot in the acetaldehyde picture is the rapid growth of pentaerythritol, raw material for a line of alkyd resins. This polyol, derived from acetaldehyde and formaldehyde, is to-day produced at an estimated 65,000,000 lb. per year, nearly twice the 1950 production rate.

Smaller current uses for acetaldehyde include the manufacture of methyl ethyl pyridine, used in the production of nicotinic acid and of dyeable acrylonitrile fibres, and chloral, intermediate in DDT manufacture.

Paraffin oxidation is only one of several commercial routes to acetaldehyde. The chief source continues to be dehydrogenation and combined oxidation-dehydrogenation of ethanol. Other commercial routes to acetaldehyde are, in order of importance: hydration of acetylene and decomposition of ethylidene diacetate or of vinyl methyl ether. Gas synthesis (Fischer-Tropsch)

operations promise to contribute significantly to the acetaldehyde supply in the near future. For a discussion of these techniques, the reader is referred to the author's recent paper (3).

2. Acetic Acid

This material is found among the organic acids produced in all commercial vapour-phase processes for the oxidation of lower paraffins. It is furthermore the preferential product of the catalytic liquid-phase butane oxidation at the Pampa plant of Celanese Corp.

Acetic acid, together with its anhydride, is by far the most important of the aliphatic acids, with the following 1954 production volume in the United States:—

Acetic acid (synthetic)	442,000,000 lb.
Acetic anhydride	690,600,000 lb.

Principal uses are in the fields of plastics and synthetic fibres production. It has been estimated that 60 per cent of acetic acid output is consumed in the production of cellulose acetate flakes; 30 per cent goes to the production of acetate esters, and the balance is taken up by applications in textile processing and by the production of metallic acetates, rubber chemicals etc.

As has already been stated, acetic anhydride, the chief derivative of acetic acid, depends almost completely on the market for cellulose acetate which accounts for some 95 per cent of total consumption. Other uses for the anhydride include the production of acetyl salicylic acid (aspirin), acetanilide, the plasticizers triacetic and acetyl ricinoleates, as well as diverse minor derivatives.

3. Acetone

Direct oxidation is but a minor source of acetone. The lion's share of this ketone continues to be synthesized from isopropanol. Since 1953, increasing amounts have been available as by-products of phenol (and cresol) production via the novel cumene autoxidation route. Shell's hydrogen peroxide plant, now under construction at Norco, La., will yield acetone as by-product as will also Stanolind's gas synthesis plant at Brownsville, Texas. Total US acetone output in 1954 was 477,500,000 lb.

The impact of these large volumes of by-product acetone has caused a perceptible softening of the acetone market, reflected in price decreases of the last two years. New

outlets are in development but their foreseeable development will not be able to keep pace with the threatening over supply in acetone.

Solvent applications in cellulose acetate manufacture and processing constitute the largest single (approx. 25 per cent) outlet for acetone. This market has been hard hit by the decline in requirements for the cellulose acetate. Other solvent uses for this ketone include the formulation of industrial lacquer (especially for automobile and furniture manufacture). This outlet continues to experience a gentle uptrend.

Acetone continues to be the most important solvent for acetylene in shipment. Here, too, some competition is threatened by dimethyl sulphoxide, a newly available commercial chemical. Various other solvent applications (e.g. for pyroxylin types of synthetic leather, in leather dopes, and for extraction dewaxing of lube oils) bring this type of market to some 35 per cent of the acetone output.

The bulk (60-65 per cent) of all acetone produced in 1955 will serve as intermediate in chemical syntheses. In first place stands the manufacture of diacetone alcohol, itself a solvent as well as intermediate in the production of methyl isobutyl ketone and carbinol, mesityl oxide and hexylene glycol. Second in importance is the production of detene, intermediate to acetic anhydride. In the United States this route to acetic anhydride has not found application in recent installations which favour acetic acid cracking and acetaldehyde oxidation. Nevertheless, the acetone cracking process in older plants continues to account for an annual acetone consumption of some 80,000,000 lb.

Some chemical importance (approx. 22,000,000 lb. per year acetone) attaches to the manufacture of isophorone, an outstanding solvent for some resins and a chemical intermediate. Probably the outstanding growth product among acetone-derived chemicals is Bisphenol-A, a condensation product of acetone with phenol. The importance of Bisphenol-A rests on its use as raw material for epoxy resins for which a very large market potential is foreseen.

4. Formaldehyde

US production of this aldehyde was 370,000,000 lb. dry basis in 1954. The bulk of this material is produced by oxidation—or, more commonly, combined oxidation—

dehydrogenation—of methanol. The available supply is augmented significantly by direct oxidation of paraffins in which formaldehyde is formed directly.

Formaldehyde is normally sold as a 37 per cent by weight aqueous solution. It has been shipped in concentrations as high as 50 per cent but at these higher strengths special provision must be made to maintain the solution at elevated temperatures in order to prevent precipitation of insoluble polymer. For most applications formaldehyde is shipped with small amounts of methanol which serves as a low-temperature self-polymerization inhibitor, but a methanol-free grade is also available. A growing shipping form is paraldehyde, the reversible trimer of formaldehyde. Paraldehyde is shipped as a water-free solid, thus saving the cost of freighting water.

Outlets for formaldehyde lean most heavily on production of plastics (thermo-setting resins) and of surface coatings. A growing outlet, synthesis of pentaerythritol, constitutes the third largest market. One US manufacturer is engaged in the production of ethylene glycol from formaldehyde. This process consumes approximately 1.75 lb. formaldehyde per lb. product. Quantity of glycol produced by this route is estimated at 70,000,000 lb. per year.

The following table shows the 1953 consumption pattern for formaldehyde, exclusive of demand for ethylene glycol:—

Market	Demand
Phenolic resins	23
Urea resins	20
Melamine resins	4.5
Hexamethylene tetramine	18.5
Pentaerythritol	19*
Misc.	15

* At time of writing formaldehyde consumption in pentaerythritol exceeds that in hexamethylene tetramine manufacture by a much greater margin.

The market outlook for phenol-formaldehyde resins is bright, and the forecast for urea and melamine type resins is stable. *In toto*, formaldehyde is a chemical with continuing good growth potential.

5. Methanol

1954 output of synthetic methanol was 1,120,000,000 lb. in the United States. Most of this is obtained by high pressure synthesis from carbon monoxide and hydrogen, but propane-butane oxidation also constitutes an economic source.

End-use pattern for methanol has been estimated (4) as follows:—

Use	Percentage
Formaldehyde	48.5
Anti-freeze	27.8
Chemical synthesis (other than formaldehyde)	8.6
Solvent, aviation and denaturant applications	8.8
Exports, inventory build-ups, misc.	6.3

The outlook for formaldehyde, itself also a product of hydrocarbon oxidation, has been discussed above. Antifreeze market for methanol has been somewhat weak in recent years largely due to warm winters and competitive antifreezes. There is some rise in the use for methanol as raw material in the synthesis of methylamines, methyl chloride, methyl methacrylate and other, lesser derivatives.

In the preceding discussion we have briefly considered the market picture for the chief chemicals produced competitively by partial oxidation of lower paraffins. It should be noted that other co-products are formed in significant amounts, among them *n*-propanol, *n*-butyl alcohol and a mixture of organic acids. These minor products contribute significantly to the attractive economics of partial oxidation.

An important aspect of oxidative paraffin conversion is the ability to control, within fairly wide limits, the ratio in which the main products are formed. Adjustment may thus be made to the changing demands of the market.

PARTIAL OXIDATION PROCESSES

Processes for the partial combustion of paraffins may be grouped into categories according to oxidizing agent and according to method of execution.

Classification by Oxidizing Agent

Air and purified oxygen are employed in commercial processes. Both approaches are somewhat similar in (reaction) execution and in product distribution. Oxygen is, of course, a more costly reagent than air, but its use facilitates product recovery and permits higher yields since the near-absence of nitrogen from tail gases permits recycling to a greater extent.

Classification by Method

For the oxidation of lower paraffins, vapour-phase conditions are chosen at all but one commercial installations. A liquid-

phase process is employed at Celanese's Pampa, Texas, plant, where butane is air-oxidized in the presence of a high-boiling solvent. Oxidation of higher paraffins to fatty acids is also practised in the liquid phase. This approach also serves in certain related oxidation processes, outside the scope of this paper, such as the conversion of cyclohexane to cyclohexanone, one step in adipic acid production.

Classification by Choice of Catalyst

Here it might be said in general that existing commercial vapour-phase oxidation processes are carried out non-catalytically. Heterogeneous (in this case solid) catalysts are employed in liquid-phase operation.

Catalytic processes are more specific as to product formation. Catalytic liquid-phase processes lead predominantly to carboxylic acids. Processes have been developed for preferential production of aldehydes or of ketones by vapour-phase oxidation, using heterogeneous catalysis as well as homogeneous catalysts.

The former approach served for the oxidation of natural gas at Cities Service Oil Co.'s original installation. This process is described by Walker (5). The catalyst is a mixture of aluminium phosphate and copper oxide. The reaction is carried out at 450-475°C and a pressure of about 300 psi. Low conversion per pass and high recycle ratios are used. 1,000 cu. ft. natural gas (60 per cent methane) yield 2.5 gallons liquid reaction product containing 5.4 wt. per cent acetaldehyde, 12.4 per cent formaldehyde, and 30.7 per cent methanol, together with lesser amounts of acetone, dimethyl acetone and higher alcohols. Most of the remainder is water formed in the course of oxidation.

Homogeneous catalysis has been employed for the production of formaldehyde from methane at a plant operated during the early 1940s by Gute Hoffnungshütte at Copșa Mica (Rumania). The process used a fresh feed of 1.0 part methane and 3.7 parts air, together with 0.08 per cent nitric oxide as catalyst. The reaction was carried out at 400-600°C. Low per-pass conversion was used so that a feed-to-recycle ratio of 1:9 was necessary. Yield of 35 per cent, based on methane consumed, was achieved.

Another instance of homogeneous catalysis is the addition of hydrogen bromide to a paraffin-air mixture. This will direct the oxidation reaction to preferential attack on

tertiary and secondary carbon atoms, in the order stated. In the case of propane oxidation it becomes possible to obtain predominantly acetone. Chief drawback of the process is the high loss in HBr which may be as much as five volume per cent of reacted hydrocarbon. The method, which is not to-day commercially employed, has recently been discussed by the author (6).

Non-catalytic oxidation in the vapour-phase (the 'shot-gun' method) is employed at all but one operating commercial plants for partial oxidation of lower paraffins (chiefly propane or butane). Obviously, the reaction is susceptible to over-oxidation and side reactions (such as butene and ethylene formation) and close control must be exerted over reaction variables. Controlling factors are inlet gas composition and method of mixing the reactants, total system pressure and partial pressure of reactants, residence time and, of course, operating temperature.

Effect of reactants concentration on individual product formation has been reported by Powers (7) for the oxidation of propane at 275°C:—

Product	Yields, per cent of carbon from propane oxidized	1:20	1:15	1:3.6	1:1.25	1:0.05
Total aldehydes	12.5	8.8	12.0	16.1	16.7	
Normal alcohols	17.3	25.5	23.0	33.1	34.5	
Isopropyl alcohol	2.7	6.9	5.2	5.2	14.4	
Acetone	1.2	1.4	1.3	0.3	7.4	
Acids	13.9	13.4	15.2	8.9	12.5	
Total condensable products	47.6	56.0	56.7	63.6	85.5	

Data for butane oxidation are reported by Quon *et al.* (8) who found an optimum oxygen concentration of 4.5 per cent (40 per cent of butane reacted, 15 per cent converted to useful product, for an ultimate yield of 35-40 per cent at the conditions selected).

In evaluating the effect of pressure, Quon obtained practically no reaction below 50 psi. Optimum performance was obtained at 125 psi. At higher pressures, increased formation of carbon oxides detracted from useful yield. It should be noted that these findings are not in accord with data on propane oxidation reported by Powers (7) who was able to obtain significant conversion at 15 psi and boosted yield to 71.7 per cent at 1,500 psi.

Temperature is of outstanding effect on performance. Yield of oxygenated chemi-

cals is highest at low temperatures. But for reasons of reaction rate, a lower practical limit is set at 250°C in non-catalytic operation. As the temperature is increased, yield of oxygenated products declines, while olefine formation rises. It is noteworthy that pressure operation tends to suppress the latter side reaction. Commercial processes are operated in the range 325-375°C (maximum).

Reaction time is controlled to a minimum of 1-1.5 seconds. Quon (8) has shown that further increase in reaction time is without effect on useful product formation, but results in increased conversion of butane to carbon oxides.

These general principles are embodied in industrial application of vapour-phase paraffin oxidation. Air (in the Celanese process) or oxygen (in the Warren and McCarthy processes), together with diluent, and feed hydrocarbon, are preheated to a mix temperature of 300-325°C, at which level the combined gases enter the converter. Either steam or recycle hydrocarbon (or both) may serve as diluent, i.e. to keep oxygen concentration at 4-5 per cent.

Immediately following the converter, the effluent gases are quenched by a water spray to not more than 180°C. After further cooling and condensation, the products are ready for separation.

Yield and product composition are, of course, subject to wide variation as a function of changes in operating conditions. Meyer (1) reports the following distribution as typical for three vapour-phase oxidation processes:—

Product	Process	Yield of Chemical, lbs./gal. hydrocarbon*		
		Celanese	Warren	McCarthy
Acetaldehyde	...	1.5	1.6	0.09
Formaldehyde	...	1.6	2.0	0.37
Methyl alcohol	...	0.98	1.0	2.26
Acetone	...	0.20	0.2	
Other	...	0.60	1.5	0.43
Total	...	4.88	6.3	3.15

* Data are for oxidation of *n*-butane in Celanese and Warren processes; ethane, propane, and some butane, as well as considerable methane in the McCarthy version.

One of the chief obstacles to early economic utilization of paraffin oxidation processes had been the severe difficulties encountered in isolating the desired end chemicals from the complex reaction product mixture. Several schemes have been developed to accomplish the necessary

separation, relying on extractive and azeotropic distillation methods as key steps. Some information has recently become available (9) on purification operations at Celanese Corporation's Bishop and Edmonton plants. This will here be briefly discussed.

In addition to the main products, which have been enumerated above, the reactor product contains other alcohols, ketones, aldehydes, as well as esters, acetals, acids, oxides etc. Furthermore, the quenching-absorption step, which follows the conversion, leads to a highly water-diluted product mixture.

Separation Difficulties

The difficulty of separation is two-fold. Not only are there close-boiling compounds in ideal mixture (such as homologues of a particular series) but, more importantly, there is a large group of binary and ternary azeotropes between oxygenated chemicals. The number of possible azeotropes in the system of butane-derived oxy-chemicals has been estimated to be close to 100.

A few examples will illustrate how extractive and azeotropic distillations serve to isolate the desired product components in the high purity required by the market:—

(1) An azeotrope with 41.8°C boiling point is formed between methylal (bp 42.3°C) and methanol (bp 64.7°C). In this instance, extractive distillation becomes possible in the presence of water (30 per cent by weight). Methylal is taken overhead. The bottom product, aqueous methanol, may be rectified in a second tower.

(2) Because of their close vapour pressures, the separation of allyl alcohol from *n*-propanol by straight fractionation is not feasible. With 75 wt. per cent water, extractive distillation can be satisfactorily carried out in a 60-plate column in which *n*-propanol is the overhead product.

(3) Methyl ethyl ketone is recovered from a crude cut by first azeotroping it off most impurities, using *n*-hexane as entraining agent. The MEK rich overhead is freed of hexane by water extraction, and the aqueous phase is sent to an extractive distillation tower in which water serves as polar solvent. The overhead is the MEK-H₂O azeotrope which is finally dried azeotropically, using pentane.

(4) Final removal of trace impurities from commercial products is carried out simi-

larly; e.g. formaldehyde from butane oxidation is brought to market specifications by a final extractive distillation with ethylene glycol.

Good yields of acetic acid, together with lesser amounts of other oxygenated products, are possible by low-temperature catalytic air-oxidation of lower hydrocarbons in the liquid phase. Such operations must be carried out at elevated pressure and in the presence of a solvent. Acetic acid, itself the main product of the reaction, is a suitable solvent for this purpose.

Loder (10) indicates that the reaction is most suitably carried out at 125-200°C. His patent covers numerous catalysts, of which cobalt acetate appears particularly active. As is frequently the case in liquid-phase oxidation reactions, there is an incubation period which may be substantially eliminated by addition of a peroxide as initiator. Since the reaction proceeds entirely in the liquid phase, conversion rate is increased by boosting the pressure for higher solubility of the hydrocarbon.

Mitchell and Luke (11) used 1,300 parts glacial acetic acid (as solvent) containing 0.3 wt. per cent chromium acetate. Liquid *n*-butane was introduced at 3.5 parts by weight per minute and air was fed into the system through a sparger at 16.35 wt. parts per minute. Operating temperature was 165-170°C and pressure was 815 psi. Overhead vapours were condensed and settled into two phases. The hydrocarbon layer is water washed and the washings are combined with the aqueous product phase for subsequent isolation of the water-soluble oxygenated products. The washed hydrocarbon is recycled to the process. This approach gave the following yields from 100 parts butane: 79.2 wt. parts acetic acid, 12.6 parts methyl acetate, 7.2 parts ethyl acetate, 1.9 parts alcohols and 6.6 parts methyl ethyl ketone.

Acetic Acid Yield

Larger yield of acetic acid can be obtained at the expense of other products by recycling the hydrocarbon phase from the reactor overhead condensate without subjecting it to a water extraction. In that event, 100 lb. butane will yield at otherwise comparable conditions: 103.7 lb. acetic acid, 9.3 lb. mixed esters, 4.5 lb. methyl ethyl ketone and 1.0 lb. alcohols.

Fatty acids of value in the manufacture of soap, detergents and plasticizers can be

obtained by air-oxidation of higher paraffins in the liquid phase. The process has been operated at three commercial plants in Germany (Witten, Ludwigshafen, Heydebreck), but has been inactive since 1953 because of the current low price of natural fatty acids.

For the production of fatty acids in the C_{10} - C_{18} range, which can be employed in soap manufacture, the most suitable starting material is a paraffin mixture in the C_{20} - C_{22} range. Ideally, the hydrocarbon should be of straight-chain character, and should contain a minimum of naphthenes, aromatics, and olefines. Oxidation inhibitors (phenols) and sulphur should be substantially absent.

Commercial Processes

The commercial process has recently been described in considerable detail by Wietzel (12). The reaction is carried out at 100-120°C. Potassium permanganate (0.1-0.2 wt. per cent on paraffin) serves as catalyst. Feed paraffin, containing the finely dispersed catalyst, is introduced into the reactor in molten form. Here, it is held for 15-30 hours in intimate contact with a stream of fine air bubbles. Air rate is about 0.7 cu. ft. per lb. paraffin charge. Cooling coils are provided in the converter.

Overhead gases are cooled in alloy steel heat exchangers. The resulting condensate forms two layers, both of which contain lower fatty acids and some alcohols. Organic products, contained in the aqueous phase in approximately 30 per cent concentration, can be recovered by extractive and distillative means. The organic layer of the condensate (approx. 7 per cent of the charge weight) is worked up with the main product stream.

Reaction time in the reactor is controlled to permit conversion of about one-third of the charge in each pass. At this point, the liquid is withdrawn from the converter. First step in the recovery stage is a water wash at 80-90°C which removes the lower fatty acids and part of the catalyst. The organic phase is next contacted with 35-40 per cent caustic soda for saponification at 95°C.

Upon completion of saponification, a phase separation is effected. The organic layer is water-washed and recycled to the oxidation stage.

The aqueous soap solution is passed, via a preheater, to an autoclave where it is held at 170°C for approximately 1½ hours in order to separate most of the contained un-

saponifiable impurities. The semi-crude aqueous soap solution is next fed to a pipe still where it is brought to 320-350°C and thence discharged to a flash pot. Here, water and residual light impurities are taken overhead. The extent of this separation may be enhanced by use of live steam.

A screw conveyor removes the semi-crude soap from the flash pot bottom, and charges it to a cooled vessel in which is it contacted with concentrated aqueous sodium sulphate solution to yield a 40 per cent dispersion. After cooling to 50°C, the dispersion is sprung with sulphuric acid to yield crude fatty acid. After phase separation, the organic layer is water-washed and then vacuum-dried at 35-40 mm. Hg. Refined fatty acids are recovered from the resulting mixture by vacuum distillation. Overall useful yield from the process is 75-80 per cent higher fatty acids and 4-6 per cent lower acids. The latter are recovered from the aqueous phase obtained by condensation from oxidizer off-gases.

REFERENCES

- (1) Meyer, R. E., *Oil & Gas J.*, 1955, 20 June, 82.
- (2) *Chemical Week*, 1954, 9 Oct., 93.
- (3) Sherwood, P. W., *Pat. Ref.*, 1955, Jan., 147 *et seq.*
- (4) Dolian, F. E., & Gwinner, W. C., *Chemical Week*, 1954, 27 Nov., 43.
- (5) Walker, J. C., USP 2,186,688.
- (6) Sherwood, P. W., *Pat. Ref.*, 1954, Dec., 144.
- (7) Powers, E. T., *Oil & Gas J.*, 1955, 29 Aug., 76.
- (8) Quon, D., *et al.*, *Can. J. of Chem.*, 1954, Sept., 880.
- (9) Hopkins, W. C., & Fritsch, J. J., *Chem. Eng. Prog.*, 1955, 51, 361.
- (10) Loder, D. L., USP 2,265,948.
- (11) Mitchell, R. L., & Luke, D. V., USP 2,653,962.
- (12) Wietzel, G., Special Supplement to *Chem. Eng. Sci.*, 1954, 3, 17.

Iran Buys British

A CONTRACT for £750,000 has just been signed between Edgar Allen & Co. Ltd. of Sheffield, and the Seven Year Plan Organization of Iran for the supply of cement making machinery and equipment for the proposed Portland cement factory at Doroud, Iran.

The plant will produce 600 tons of cement daily. This is said to be the first instance since the war of an order for a plant of this description being secured in the face of international competition.

The equipment, which includes two rotary kilns 330 ft. long by 9 ft. and 10 ft. 6 in. diameter, primary crusher, wash mills, tube mills for raw and finished materials, together with all ancillary equipment, will be fabricated at the Imperial Steel Works, Sheffield.

Mercury Industry, 1954

Survey by US Bureau of Mines

THE US mercury industry in 1954 was characterized by new peak daily, weekly, and annual prices, by a continued uptrending domestic production, by sharply reduced imports particularly in the final quarter, by curtailed industrial consumption, and by reduced inventories, according to the Bureau of Mines, US Department of the Interior.

Total supplies of mercury in 1954, although smaller than in 1953, were more than twice as large as industrial consumption. Production in 1954 was 29 per cent above 1953 but the total was far below those for 1940 to 1947, inclusive, for 1929 to 1931, and for many years prior to 1920. Total imports of mercury (general) dropped 24 per cent from 1953 but continued above all but three earlier years. Receipts in 1954 were again chiefly from Spain and Italy with important quantities from Mexico and Yugoslavia.

Chief Increases

World production rose in 1954 but not as much as was to be expected under prevailing prices. Spanish output matched the rate for 1953 despite expanded capacity, and Yugoslavia's output was also unchanged. Italian production increased six per cent. The chief percentage increases of 60, 29 and 27, respectively, were in Japan, US, and Mexico.

US consumption of mercury in industrial uses in 1954 was 18 per cent below 1953, and except for 1952, was the smallest since 1949. The decline in consumption resulted chiefly from the fact that for the first time in several years no new industrial installations using mercury, such as chlorine and caustic soda plants and mercury power boilers, were put into operation.

The average annual price in the US established a new peak in 1954, 37 per cent more than in 1953 and 26 per cent above the previous record in 1951. Quotations were \$187 to \$189 at the beginning of the year and rose without interruption to \$325-\$330 in early November, weakened to \$318 to \$320 by mid-December, and closed the year at \$322 to \$324. Mercury prices in London also established new peaks, rising from £61 15s to £110 to £111.

More mercury was produced in the world in 1954 than in any other year since 1943;

the quantity was higher than all earlier annual totals except in 1940 to 1943, inclusive. The increase was 11 per cent over 1953.

Dunlop Plantations

DEVELOPMENTS to Dunlop's Malaya plantations which began on a small scale in 1948 were described on 19 December by Mr. Donald W. Hawkins, general manager of the plantations. A complete planting-replanting programme is being carried out which will cost about £4,500,000. About £1,000,000 will be spent on a building-rebuilding programme, making a total cost of £5,500,000 in all.

The last tree will be in and the last building up by 1962 if everything goes according to plan.

Tentative plans for planting in Nigeria were also announced. The project has not yet started and no land has been leased. Dunlop have no doubt at all of the success of this new venture, said Mr. Hawkins. The soil is known to be good.

Mr. Hawkins said that Dunlop had great faith in natural rubber. When questioned about synthetic rubber he said that for some purposes the natural product was superior. In any case the demand for rubber was so great that there was room for both natural and synthetic material.

By 1962-70 the plantations, Malaya and Nigeria together, should be able to supply all of Dunlop's latex requirements. At present substantial quantities are purchased from small independent plantations.

Malayan Protests

LEADING rubber traders in Malaya have protested against the building of synthetic rubber factories in Britain.

On 14 December Mr. Heah Joo Seang, president of the Federation of Rubber Trades Associations, urged Malaya's Chief Minister, Tengku Abdul Rahman, to protest strongly against the British Government's decision to approve construction of such factories.

Mr. Heah Joo Seang also protested against the reported action of the Board of Trade in selling rubber to American dealers for the purpose of repaying stocks borrowed from the American Government's stockpile.

Austrian Chemical Industry

Opportunities for UK Chemical Plant

THE Federation of British Industries has issued the report of a small mission which it sent to Vienna in October to examine the re-equipment of factories and public services restored to Austrian control under the Austrian State Treaty of last May. Seven industries were studied by the mission, which consisted of a leader, Sir John Duncanson, and six expert members nominated by particular trade associations. Each member of the team contributed a section of the report covering the particular industry that he studied.

The chemical plant section, which was written by Dr. E. H. T. Hoblyn, M.B.E., director of the British Chemical Plant Manufacturers' Association, is given below:

Chemical plant covers a wide field and opportunities to sell it in a given territory can seldom be shown in any clear-cut pattern, but an examination of the general structure of the chemical industry of that territory usually reveals openings for the products of one group of firms or another. This section therefore comprises a brief description of the Austrian chemical industry, followed by an indication of the nature of the competition to be faced and the action which must be taken if firms in the British chemical plant industry are to take advantage of their present unique opportunity to sell to a territory to which, generally speaking, too little attention has been given in the past.

Austria's Third Largest

The chemical industry is Austria's third largest industry with a production over double that of 1937 and valued for 1954 at £70,000,000. It is also expanding more rapidly than most other sections of Austrian industry. It should be appreciated, however, that by definition chemical industry in Austria covers a very much wider field than in the UK. This is illustrated in the membership of the Federation of the Chemical Industries of Austria, whose activities cover not only chemicals and pharmaceuticals but, for example, plastics, manufactured plastics goods, paints and varnishes, inks, shoe-leather, floor polishes and matches.

The total membership of this Federation

is about 700, of whom 200 firms are of such size or progressiveness that they can be regarded by UK equipment manufacturers as potential customers.

The principal products of the Austrian chemical industry are heavy chemicals and fertilizers. The production of nitrogenous fertilizers was 568,000 tons in 1954, while a new superphosphate plant with a capacity of 80,000 tons per annum was recently put into operation. This is much more than is needed for home consumption; fertilizers, therefore, constitute an important Austrian export and an expansion of production can be anticipated.

Self Supporting

Austria is at present self-supporting in sulphuric acid, some 30,000 tons per annum being made from zinc smelting gases and 40,000 tons per annum by the anhydrite process.

There is one calcium carbide plant, the acetylene produced therefrom providing the starting material for the manufacture of chlorinated solvents including trichlorethylene and perchlorethylene. Calcium carbide production is in the order of 20,000 tons per annum.

Chlorine and caustic soda are produced electrolytically in three plants, the approximate annual output of caustic soda being 50,000 tons. The output of soda ash is about 100,000 tons per annum, a proportion being converted to caustic soda.

Austria is mainly dependent for her tar products on the crude tar from gas works and principally the coke ovens of the steel works in Linz. The production of tar products is steadily increasing and is at present about 75,000 tons per annum. This is a marked step forward from the past when Austria had to meet most of her demand for these materials by importing and increased attention to their production is to be expected.

Considerable progress has also been made by the Austrian pharmaceutical industry. Pre-war some 80 per cent of Austria's pharmaceutical needs were imported; now the figure is only 20 per cent. Penicillin requirements are now fully met by local produc-

tion and manufacture of streptomycin is planned.

Plastics production has been greatly developed since the war. Domestic needs for phenol-formaldehyde moulding powders can now be met by local production, which also provides urea moulding powders and resin glues based on urea-formaldehyde. Production of polyvinyl chloride was commenced during 1953. Some plasticizers are available based on phthalic anhydride manufactured from locally produced naphthalene.

Rayon production is concentrated in two firms, one of which produces staple fibre and viscose foil and the other continuous filament. These industries have been kept up to date and expanded since the war but there is a clear desire to apply the latest machinery developments and to produce types of rayon to meet all its applications.

Paint Imports Small

Demand for paints is met to only a small extent by imports. There is local production of lead, barium and zinc compounds as pigments and recently a new plant was started up with an annual output of 5,000 tons of lithopone.

Although petroleum forms a separate section of this report mention must be made here of petro-chemicals. It seems certain that as soon as reasonably possible a petro-chemical industry will be established in Austria.

Looking at the overall picture it is important to remember that Austria has been very dependent on Germany for her technical developments and there is a sad shortage of trained technical men in Austria because her young men, when trained, immediately leave for much better paid positions in Germany. Unless this trend is stopped Austria will always be dependent, to a marked extent, on technical help from outside and very definite interest was shown by firms now released from Russian control in linking up with appropriate British chemical manufacturers.

The above information indicates that while the Austrian chemical industry is not large, it is progressive. Many plants were overworked during the war years and have had little done to them during the Russian occupation. Equipment is therefore required not only to meet desired expansion but in many cases for replacement and modernization.

The fields in which there will probably be the greatest opportunities are petro-chemicals, fertilizers, tar products, pharmaceuticals, plastics and rayon.

The Austrian chemical industry has been by tradition equipped from Germany. The names and products of German firms are well known and German technical journals are those normally read. The language spoken is the same, the weights and measures are the same, distances between equipment supplier and user are often quite short and there is no shipping problem. In short, Austria has been an extension of the German home market.

The Austrian chemical industry provides a market in which, for the sake of its reputation, the British chemical plant industry should have an important share. As mentioned elsewhere in this report, there is now an opportunity which will probably never occur again to enter this market. At the risk of repetition the following points are emphasized as being those to which attention must be given if business is to be done with Austria. Literature and correspondence must be in German, the metric system must be used and prices should be quoted as 'Free Austrian Frontier'. The Austrian is attuned to receiving from Germany prompt attention to his needs and good after-sales service; this must be matched by British firms.

It was found that too little was known of the British chemical plant industry and considerable interest was expressed on learning of its achievements and capabilities. It is urged therefore that UK equipment manufacturers ensure that their prospective customers in Austria are made fully aware of their products; and so that they may do so a classified list of Austrian chemical manufacturers is being sent to all members of the British Chemical Plant Manufacturers' Association with this report.

Italian Oil Well

Oil at a depth of 500 ft. has been struck at Tocco Casauria in Abruzzo, Italy, by a company affiliated to the State Hydro-carbon Organization. A vacuum lift test is to be made in the well and the drilling will continue to a lower depth. The new well is 40 miles from Alanno, where the Gulf Oil Corporation and the Italian State Company have both discovered important oilfields.

IN THE EDITOR'S POST

Laboratory Explosion

SIR.—We would like to draw the attention of chemists to an explosion that occurred in this factory when an attempt was being made to prepare triphenyl-arsine according to the method described by W. E. Hanby and W. A. Waters (*J.C.S.*, 1946, 1030) and reproduced in 'The Preparation of Organic Intermediates' by D. A. Shirley (John Wiley & Sons, 1951).

The preparation was being attempted on three times the recorded scale as follows:—

A solution of 900 g. of aniline in 1.2 l. of water and 3 l. of concentrated hydrochloric acid was diazotized by the addition to the cooled solution (0–10°C) of a solution of 660 g. of sodium nitrite in 750 ml. of water. The mixture was maintained at 0°C with stirring while a solution of 840 g. of zinc chloride in 360 ml. of dilute hydrochloric acid was added slowly. The precipitated salt was filtered off by suction, pressed free of water on the filter and washed with 1.5 l. of dry acetone to free it from moisture.

To implement the instruction that it must be thoroughly dry before the next stage in the preparation, the chemist carrying out the preparation placed the zinc benzene-diazonium chloride so obtained (approx. 1.5 kg.) in two glass dishes which were then transferred to shelves in a small vacuum oven, which was to serve as a vacuum desiccator. A small dish of phosphorus pentoxide was placed at the bottom of the oven beneath the lower shelf carrying one of the trays of the zinc benzene-diazonium chloride.

The oven was then evacuated and remained so, as far as can be determined, until the explosion occurred the next morning, some 15 hours later.

The oven was not heated, careful inquiry indicating that it was not touched during the night.

The explosion was of great violence, shattering the oven and neighbouring equipment to fragments. One assistant, working about four yards away from the oven, received severe cuts on the head and body and a fractured hand, while two other assistants received lesser cuts.

It is well known that several simple diazonium salts, such as benzene-diazonium chloride itself, are explosive when dry, explosion being initiated by slight friction or heat. However, the double salts with zinc chloride are considered to be very much more stable and it is difficult to explain the instability of the intermediate prepared on this occasion, except by assuming that other experimenters have been more fortunate in their experience with this substance. The only respect in which the procedure seems to have differed from that used by Hanby and Waters is in the time during which the substance was stored in a dry state. Since it must have been more sensitive than was believed, it is possible that a change in the vacuum pressure or vibration on the bench supporting the oven when the day work started, soon after 8 am, was responsible for initiating the explosion.

I have been in touch with Dr. Waters (Balliol College, Oxford) about the incident and am glad to include his comments on it, as follows:—

(1) With many potentially explosive solids detonation may result from frictional heating of dry crystals. This risk can be diminished greatly by the retention of even a slight film of solvent (e.g. the acetone).

(2) I would deprecate the drying of any unstable compound in a desiccator containing such an easy dispersible powder as phosphorus pentoxide, since on evacuation traces of this chemically active dust could be blown on to the stored solid, and perhaps might interact with it to produce local heating.

(3) Diazo-compounds are known to be photo-sensitive. I have had experience (fortunately in an empty room) in which a diazo-compound (not the zinc diazonium chloride) kept in a vacuum desiccator exploded after over-night storage, and have suspected that sunlight focused through the glass of the desiccator lid might have caused local heating.

Yours faithfully,

G. D. MUIR.

Manager, Organic Chemicals Department,
BDH Laboratory Chemicals Group,
Poole, Dorset.

Glaxo Laboratories Ltd.

Chairman Reviews Year's Progress

AT the 21st annual general meeting of Glaxo Laboratories Ltd., held in London on 13 December, Sir Henry Jephcott, M.Sc., F.R.I.C., F.P.S., chairman and managing director, said in his review of the year ended 30 June 1955, that the company's cortisone, manufactured from hecogenin—a substance obtained from sisal grown in East Africa—was now in commercial production and the output was steadily increasing as the supply of raw material expanded.

Building Programme Under Way

A building programme estimated to cost some £600,000, to which he had referred in his report for the previous year, was now being carried out though, in common with many such capital projects, not with the speed that the company had hoped. More office space was being provided at the company's Greenford headquarters to enable temporary accommodation to be vacated and to secure a closer and better co-ordination of some of the firm's activities than was at present possible.

Early next spring the company's departments of experimental medicine and bacteriology would move into a new block that would provide adequately for the expansion of work in those fields. In addition, extensions were being made to the company's factory buildings, but these would not be completed until towards the end of 1956.

The chairman went on to say that a very substantial part of the company's activities was the production of pharmaceutical products to meet medical needs. Great changes were taking place owing to the rapid accretion of new knowledge. New drugs of more specific action were discovered, and replaced the old. Some new discoveries became permanently established; others did no more than meet a passing need.

If the company was to maintain its position it must use every effort to keep abreast of new developments, and for that reason the company's annual expenditure upon research and development was necessarily high and now exceeded £500,000.

It was now established that some antibiotics, for instance streptomycin, had valuable application in horticulture,

especially in the prevention and cure of certain fungal diseases of plants. The company's research department had been concerned with this development for some time, and large-scale field experiments had been supported with encouraging results. Since the company had not any experience in the marketing of horticultural products, it had acquired the Murphy Chemical Co. This company had been long established in this field and had a high and well-deserved reputation. It would continue to operate as a separate organization and under the same management, but in close co-operation with Glaxo.

Sir Harry added that it would be necessary to make a further substantial investment in the Murphy Chemical Co. in order to provide adequate facilities for its expanding business.

Canadian Resins Plant

AMERICAN-Marietta Co. of Canada, producers of adhesives and resins, mainly for the plywood industry, will build a new plant at Edmonton for production of synthetic resins.

The new plant will serve the plywood and allied industries in Alberta. Plentiful supplies of essential chemical raw materials, e.g. formaldehyde, later urea, will be available from nearby chemical plants. Plans have now been completed for purchase of the Edmonton property and equipment is on order. The company operates a modern adhesives and resins plant at New Westminster, BC. An expansion move is currently under way at this plant.

American-Marietta Co. of Canada is a subsidiary of American-Marietta Co., Seattle, Washington. The adhesive, resin and chemical division of the US company has plants in Seattle and Portland serving the wood industry in this area.

Factories Report

The Annual Report of the Chief Inspector of Factories for 1954, published last week by HMSO (price 8s), states that the factory population was greater than that recorded the previous year, which was the highest then recorded in times of peace. The increase in accidents from 181,637 in 1953 to 185,167 in 1954 reflected this increase in the number of persons at risk.



ELECTROLYTE SOLUTIONS. By R. A. Robinson & R. H. Stokes. Butterworth's Scientific Publications, London; Academic Press Inc., New York. 1955. Pp. xiii + 512. 56s.

As the sub-title indicates, the chief topics of this book are conductance, chemical potential and diffusion. These are the fundamental phenomena of electrolytes, and the authors treat them from the standpoint of the practical electrochemist.

Conductance is the chief distinguishing characteristic of electrolyte solutions. As a result of the recent work of Falkenhagen the theory of conductivity for solutions of laboratory concentration is now almost completely adequate. The authors have performed a very useful work in presenting this theory to the general chemical public in a critical yet readable form. The spectacular conformity between calculation and measurement is illustrated at every opportunity.

On the other hand, as the authors point out, the interpretation of chemical potential data has not yet reached an entirely satisfactory stage. They have, however, given a very useful survey of the position at the present time. Their frank analysis will help many workers in this field to avoid some of the less obvious pitfalls.

Finally, a lot of attention is given in the book to the phenomenon of diffusion in electrolyte solutions. It is only in comparatively recent times that precise experimental data have become available in this field, and this is therefore the first occasion on which the subject has been fully and critically discussed.

At the end of the book there are extensive appendices and tables containing accurate and up-to-date experimental data. References to the original literature are quoted in each instance. The standard of production is very high and the price reasonable.—H. MACKLE.

PROCESS ENGINEERING ECONOMICS. By H. E. Schweyer. McGraw-Hill Publishing Co. Ltd., New York & London. Pp. 409. 52s 6d.

This book is a really valuable addition to the McGraw-Hill chemical engineering series, and is quite without parallel in its own field. It provides on the one hand a clear and simple exposition of the role of finance and economic practice in productive industry, and on the other a complete factual course in the accounting methods essential to mathematical manipulation of the theories involved. Thus the general interest reader and the student are at once catered for.

Of course, the work has a distinctive American approach, and indeed some accounting terms such as 'break-even cost', 'iso-cost', or 'going-cost' need clarification for English ears. But all such terms, and their exact mathematical interpretation are clearly defined, so that they provide no real obstacle. Also the tenor of the book calls to mind two general comments concerning its material; firstly the apparently growing use of the term 'process engineering' to cover those processes in which matter undergoes physical, chemical or biological change—a welcome reversal of the practice of subdividing engineering by title into ever smaller pieces; secondly the obvious belief of the author that engineers must be directly concerned with costs and their control. One wonders how far this is yet applied in British industry, where, despite the efforts of the few, the suggestion that engineers should know what their costs are besides keeping them low is regarded as a somewhat indecent one.

This book, then, should be read by everyone concerned with production costs, even if some of the techniques and practices are not at first sight acceptable by British standards.—T. K. ROSS.

Synthetic Rubber from US

THE Government has decided to authorize the import in 1956 of 70,000 tons of synthetic rubber from the US, of which 50,000 tons is in the form of GR-S, the main general purpose type which is competitive with natural rubber. This amount represents the estimated requirements of UK manufacturers for 1956.

Announcing this in a written Parliamentary reply on 13 December, Mr. A. R. W. Low, Minister of State, Board of Trade, said that as far as the balance of payments permitted, the Government's policy was to allow UK manufacturers a free choice of materials. Synthetic rubber had technical advantages over natural rubber for certain uses; at present it was also considerably cheaper.

The Minister went on to say that while he was aware of the importance of rubber to the Malayan economy and to the sterling area's balance of payments, UK consumption of rubber in relation to total world production was comparatively small. Even if the Government felt justified, which it did not, in denying UK manufacturers any access to supplies of synthetic rubber, it would have at most a marginal effect on the market for natural rubber which reflected the supply and demand position in the world as a whole.

It made no difference to the amount of natural rubber sold where the increased consumption of synthetic rubber took place. Mr. Low continued. It might, however, make a serious difference to the exports of the British rubber manufacturers if they were denied access to imported synthetic rubber while their competitors used it freely.

Dunlop Rubber Research

RESEARCH in corrosion technology has produced from the laboratories of Semtex Ltd., the Dunlop subsidiary, a low viscosity partially condensed resin syrup of the Furane type which improves the resistance of concrete to corrosion by the mild acids and other reagents that attack the cement in it. Furacrete, which can be used to advantage in the brewery, dairy, food and chemical industries, replaces part of the gauging water during the mixing. When the cement is hydrated in the normal manner the resin remains distributed until such time as acid

solutions come into contact with the concrete. These acids cause the resin to harden into a corrosion resistant mass and dilute acids cannot then attack the cement.

A new industrial coating for applying to mild steel, cast steel, cast iron and aluminium surfaces also comes from the Semtex laboratories. Semprene, based on a synthetic rubber, is supplied in the form of a base coating and an accelerator which are mixed together in specified proportions before application when the rubber vulcanizes at normal temperatures giving a tough self-adherent coating to resist corrosion.

Food & Chemistry Course

A LABORATORY course will be given by Dr. E. Barton Wright at the Borough Polytechnic, London, on Wednesday evenings, from 18 January to 21 March, 6-9 p.m. The course will include treatment of the theoretical principles of the various methods of microbiological assay of vitamins, and laboratory work will include the assay of the following vitamins: riboflavin, nicotinic acid, thiamine, biotin, pantothenic acid, folic and felinic acid, the vitamin B₆ complex and cyanocobalamin (vitamin B₁₂).

A course of six lecture-demonstrations with practical work on monolayer techniques will be given by Dr. K. G. A. Pankhurst at the Borough Polytechnic on Wednesday evenings, from 8 February to 14 March, 6-9 p.m. The course will include a consideration of insoluble monolayers with surface balance techniques and of soluble monolayers with surface tension techniques.

The numbers in both these courses will be limited, in order that adequate space will be available for laboratory work, and applications or requests for further details should be sent as soon as possible to The Borough Polytechnic, Department of Chemistry and Food Technology, London SE1.

Change of Address

James A. Jobling & Co. Ltd., manufacturers of Pyrex brand laboratory and scientific glassware, announce that Mr. W. Webber, their Midland area technical representative, is now resident at 81 Greswolde Road, Solihull, Warwickshire.

• HOME •

Patents Act 1949

Under Section 35 of the Patents Act, 1949, the undermentioned patents were endorsed 'Licences of Right' on 17 November: 602,129, nickel catalysts, applied for by Societe des Usines Chimiques Rhone-Poulenc; 729,334, rubber mixtures which only burn with difficulty, applied for by Phoenix Gummiwerke Akt/Ges.

Biggest Chemical Factory

Speaking before a branch of the Institution of Electrical Engineers in November, Mr. J. W. Kerr of ICI, Billingham, said that they had been accustomed to saying that Billingham was the biggest chemical factory in the British Commonwealth. Now that Billingham and Wilton were joined by a pipeline under the Tees they could say that the combined factory was the biggest chemical factory in the world.

Trade Effluent Problem

Trade effluents accounted for an estimated 45 per cent of the aggregate dry weather flow at the works of the Birmingham Tame and Rea District Drainage Board, says the report for 1951-55. The board says that sewage at some works contained salts of nickel. Most firms took precautions to avoid this wastage but the amounts found in the sewer pointed to gross negligence somewhere, if not to misuse of the sewers and sewage purification facilities.

Rubber Shortage

Available supplies of natural and synthetic rubber were likely to remain barely sufficient to cover essential requirements, and any urgent orders for near delivery might have a disproportionate effect on the price, said Sir Eric Miller, chairman of Harrisons & Crosfield, at a company meeting on 12 December. The wide price differential was bound to boost the offtake of the improved synthetic latices when they were in more adequate supply.

THE CHEMICAL AGE Subscriptions

With effect from 7 January 1956, the annual subscription rate (home and overseas) for THE CHEMICAL AGE will be increased to 52s 6d. The price of single copies will be increased to 1s 3d, by post 1s 6d.

Refresher Course Record

The Incorporated Plant Engineers announce that the entry for their comprehensive refresher course for works and plant engineers in London and the Home Counties, which began at the Royal Empire Society, London, last month, was a record, 550 engineers being enrolled.

Christmas Lectures

The Christmas Lectures of the Royal Institution will be held on 27, 29 and 31 December and 3, 5 and 7 January at 21 Albemarle Street, London W1. The lecturer is Professor H. W. Melville and the subject is 'Big Molecules': 1—'The Making of Big Molecules', 2—'The Size of a Molecule', 3—'Rubber and the Rubber-Like State', 4—'Man-Made Fibres', 5 & 6—'Plastics from Big Molecules'.

Preservative Test

The British Food Manufacturing Industries Research Association, at Leatherhead, has recently further developed the sulphite preservative solutions test for estimating the strength of sulphur dioxide solutions in preserving fruit for jam manufacture. The equipment and chemicals for the original test are available through the Food Manufacturers Federation, 4 Lygon Place, London SW1, price £1 10s. Under the BFMIRA development, the test can now be used for fruit preserved in sulphur dioxide.

15,000-Mile Sales Tour

Mr. E. L. Harrison, sales director of Quickfit & Quartz Ltd., manufacturers of interchangeable laboratory glassware, of Stone, Staffs, will leave this country immediately after Christmas on a 15,000-mile sales promotion tour of Europe, India and North Africa. During his two-months' tour Mr. Harrison will visit Switzerland, the Netherlands, Athens, India, Cyprus, Israel and Egypt.

Welding Developments Lectures

The sixth in the series of two-day meetings on increasing production by recent developments in welding and design techniques organized by the British Welding Research Association will be held at the Nottingham Mechanics' Institution on 7 and 8 February.

• OVERSEAS •

Israel Resumes Trade With Japan

Israel has resumed the export of potash to Japan after an interval of 15 years. The first consignment of 4,000 tons was recently shipped from Haifa. As Japan has announced its intention to buy considerable quantities, Israel plans to extend its potash production.

Rhodesian Minerals

The value of minerals produced in Southern Rhodesia in the first nine months of this year totalled £15,180,655, an increase of £1,281,152 over the figure for the corresponding period last year.

Wolfram Ore Deposits

The reserves of wolfram ore deposits discovered at Uludag, Turkey, last year, are now estimated to be the fourth richest in the world.

Norwegian Aluminium

The annual capacity of Norway's aluminium industry will be raised by 70,000 tons to 170,000 tons by four projects, of which one is almost completed and three are in the planning stage. Two of the plans have been drawn up by the State owned A/S Ardal og Sunndal Verk, one by Elektrokemisk A/S. and one (nearly completed) by Det Norske Nitridaktieselskap.

Australian Pyrites Record

The production of flotation pyrites concentrate at the Mount Morgan mine, Queensland, during the 1954/55 season amounted to 81,000 tons, or 22,950 tons more than in the previous year. The bulk of the concentrate was purchased under contract by the British Phosphate Commissioners and stockpiled at Mount Morgan.

German Documentation Centre

A documentation centre for literature on atomic energy and radioactive isotopes has been opened in the House of Technology in Essen, West Germany. About 70 scientists have volunteered to assist in collecting, sorting and evaluating specialized material for the centre. It is planned to hold courses at the centre for training employees of industry in nuclear physics. Such courses are to include an introduction to the construction and operation of the approximately 20 types of atomic reactors now in existence.

Butadiene Plant Enlarged

The capacity of the butadiene plant of the Continental Oil Company and the Cities Service Company at Lake Charles, Louisiana, US, will be increased by a \$4,350,000 expansion programme which will raise output to 79,000 tons annually from the present 63,000 tons. Work on the project is due to be completed by next autumn.

Reclaimed Site

Four large tanks, each capable of holding nearly 15,000 tons of fuel, or diesel oils, have been built by Shell Petroleum on a 10 acre site reclaimed from the sea at Dakar in French West Africa. The Dakar authorities have built a petroleum wharf and altogether £950,000 has been spent in developing the tanker handling facilities of the port.

Vochema '56

It has been decided in principle that the third Vochema Trade Show will be held from 9 to 17 October, 1956, inclusive, on the Croeselaan site in Utrecht, probably in the Bernhard Hall. Information regarding participation can be obtained at the secretariat of the 'Stichting Vochema', Tournooiveld 4, The Hague, Holland.

NZ Fertilizer Works

The Southland Co-operative Phosphate Co. of New Zealand may have cabinet approval for the construction of a farmer-owned fertilizer works in Southland, provided that £250,000 can be raised locally. In a letter to the company, the Prime Minister, the Rt. Hon. S. G. Holland, said he would recommend to the cabinet that the organization should have authority to go ahead with its project if Southland farmers were prepared to subscribe their share of the capital.

Indian Sugarcane Congress

The Ninth Congress of the International Society of Sugarcane Technologists will be held in Delhi in January and February 1956.

Nearly 300 foreign and 300 Indian delegates will assemble in Bombay on 4 and 5 January and, according to the tentative itinerary, will visit selected factories, plantations and research stations before the session opens at Delhi. Symposia on the manufacturing and engineering sides of the sugar industry will be held.

PERSONAL

MR. E. A. S. ALEXANDER, managing director, United Glass Bottle Manufacturers, has been elected president of the Glass Manufacturers' Federation for the third year in succession. DR. W. MASKILL has been re-elected chairman of the executive committee and MR. A. W. CLARK has been re-elected vice-chairman of the executive committee.

At the annual general meeting of the British Tar Confederation on 21 November, the following were elected as officers of the confederation for the year 1955/56: *President, SIR HAROLD C. SMITH, K.B.E. D.L.; honorary treasurer, MR. L. W. BLUNDELL; chairman of the executive board, MR. HENRY F. H. JOHNS, M.B.E.; vice-chairmen of the executive board: MR. R. H. E. THOMAS, O.B.E., and MR. STANLEY ROBINSON.* With one further nomination still to be made by the British Coking Industry Association the following constitute the executive board for the year 1955/56: *Representing the Association of Tar Distillers: MR. L. W. BLUNDELL, North Thames Gas Board; MR. C. E. CAREY, South Eastern Gas Board; MR. J. COLLIGON, Dorman, Long (Chemicals) Ltd.; MR. E. HARDMAN, E. Hardman, Son & Co. Ltd.; MR. C. LORD, Lancashire Tar Distillers Ltd.; MR. WM. MCFARLANE, Scottish Tar Distillers Ltd.; MR. STANLEY ROBINSON, Midland Tar Distillers Ltd.; MAJOR A. G. SAUNDERS, The Prince Regent Tar Co. Ltd.; MR. J. B. VICKERS, Yorkshire Tar Distillers Ltd.; and MR. W. A. WALMSLEY, Thomas Ness Ltd.; Representing the British Coking Industry Association: LT-COL. P. F. BENTON-JONES, United Coke & Chemicals Co. Ltd; MR. J. BERRESFORD, Staveley Iron & Chemical Co. Ltd.; MR. G. W. J. BRADLEY, National Coal Board (East Midlands Division); MR. K. MCK. CAMERON, Stanton Ironworks Co. Ltd.; MR. F. W. O. DODDRELL, National Coal Board (North Eastern Division); MR. C. F. DUTTON, National Coal Board; MR. C. M. FRITH, South Yorkshire Chemical Works Ltd.; MR. C. F. SULLIVAN, National Coal Board (South Western Division); and MR. R. H. E. THOMAS, O.B.E., National Coal Board; Representing the Gas Council: MR.*

S. BLACK, Northern Gas Board; MR. D. D. BURNS, O.B.E., Scottish Gas Board; MR. E. H. HARMAN, East & West Midlands Gas Boards; MR. W. HODKINSON, O.B.E., North Western Gas Board; MR. W. K. HUTCHISON, C.B.E., South Eastern Gas Board; MR. HENRY F. H. JONES, M.B.E., Gas Council; MR. A. McDONALD, North Eastern Gas Board; MR. M. MILNE-WATSON, C.B.E., Eastern & North Thames Gas Boards; MR. J. POWDRILL, M.B.E., Wales Gas Board; and MR. S. E. WHITEHEAD, O.B.E., J.P., South Western & Southern Gas Boards; *Representing the Low Temperature Coal Distillers' Association of Great Britain Ltd.: COMMANDER COLIN BUIST, M.V.O., R.N. (Retd.).*

SIR HARRY JEPHCOTT, while remaining chairman of Glaxo Laboratories Ltd., retires under the company's superannuation scheme from the executive position of managing director on 31 January, 1956. He will continue to be closely associated with the company's research and development activities and with the operation of overseas subsidiary companies. He will be succeeded as managing director by MR. H. W. PALMER, B.Com. Miss I. TOWNSEND, export director, retires on 31 December after 37 years' service. MR. R. A. LANGRIDGE, F.R.I.C., F.P.S., has been appointed export manager.



Mr. H. W. Palmer

Mr. Palmer, who takes up his appointment as managing director of Glaxo Laboratories on 1 February, 1956, joined the company in 1928 and has been deputy managing director since 1948. Mr. Palmer has taken a major part in the great expansion of the company's operations of recent years. As production manager and development director he undertook special responsibilities for major building and plant installation projects. These projects included, at home, the erection of antibiotics plants at Barnard Castle and Ulverston, a cortisone-producing

plant at Montrose and the company's headquarters at Greenford. The extensive building programmes of factories, laboratories and offices overseas—notably in Australia, New Zealand, Italy, India and Pakistan—have also been carried out to plans closely supervised by Mr. Palmer. In his early days with the company, Mr. Palmer spent a considerable time in Belgium and later a year in Australia. Since then he has travelled all over the world in assisting the development of the company's interests overseas. He has recently returned from a visit to Turkey, India and Pakistan. In 1940 he was appointed a director of Glaxo Laboratories Ltd., then a private company. When, on 30 January, 1947, Glaxo Laboratories Ltd. became a public company, absorbing the 'parent' company, Joseph Nathan & Co. Ltd., Mr. Palmer became an executive director of the new organization. Eight months later, in September, 1947, he was appointed to the board. He was appointed deputy managing director in November 1948.

MR. K. L. SMITH was elected chairman of the Biological Methods Group of the Society for Analytical Chemistry at the group's annual general meeting in London on 9 December. MR. S. A. PRICE, B.Sc., was elected vice-chairman, and MR. K. A. LEES, of Glaxo Laboratories Ltd., Sefton Park, Stoke Poges, Bucks, was elected honorary secretary and treasurer.

MR. P. J. C. BOVILL, J.P., the assistant managing director of Newton Chambers & Co. Ltd., of Thorncleif, Sheffield, has accepted an invitation to join the board of the Wellman Smith Owen Engineering Corp. Ltd. Newton Chambers supply Wellman Smith Owen with a considerable volume of fabricated steelwork for furnaces and crane structures, and heavy iron castings. On 1 July this year, Mr. Bovill accepted an invitation to join the board of Newton Chambers & Co. Ltd. with a view to succeeding the managing director, SIR HAROLD WEST, who is to retire next year.

LIEUTENANT-COLONEL S. J. M. AULD has been appointed a member of the Ministry of Fuel and Power advisory council.

The resignation of SIR EDWARD C. BULLARD, Sc.D., F.R.S., from the directorship of the National Physical Laboratory takes effect on 31 December 1955. The

appointment of a successor to Sir Edward Bullard will be announced in due course. In the meantime, and pending the taking up of office by a new director, the Lord President of the Council has appointed DR. R. L. SMITH-ROSE, C.B.E., D.Sc., M.I.E.E., director of radio research in the Department of Scientific and Industrial Research, to be acting director, with effect from 1 January 1956.

Tube Investments Ltd. announces the appointment of DR. T. P. HUGHES, M.A., Ph.D., as director of the Tube Investments Research Laboratories at Hinxton Hall, Cambridge. DR. F. P. BOWDEN, F.R.S., is the chief research consultant to Tube Investments Ltd. Dr. Hughes was head of the chemistry department and subsequently chief superintendent of the rocket propulsion department of the Royal Aircraft Establishment before joining TI.

PROFESSOR A. J. BIRCH, professor of organic chemistry at Sydney University, left Sydney on 13 December to take the chair of organic chemistry at Manchester University. Professor Birch says he regards Manchester as the most important centre in the field of organic chemistry in the Commonwealth.

Obituary

MR. JAMES COSSEY, M.Sc., A.R.C.S., A.R.I.C., D.I.C., head of the technical sales department of Borax Consolidated Ltd., died suddenly from a heart attack on 14 December, aged 42. Born at Ormesby St. Michael, Norfolk, Mr. Cossey took his degree in chemistry at the Royal College of Science, London, where he studied from 1932 to 1935. During the war he served with the RAF, re-joining Borax in 1946. During recent years Mr. Cossey had travelled extensively abroad to study markets which had given him a specialized knowledge of the borax industry.

For many years a senior sales representative of George Kent Ltd., scientific and industrial instrument manufacturers of Luton, Beds, MR. E. F. FOSTER, M.Inst.F., died on 9 December, aged 56. Mr. Foster joined the company in 1915 and after service in the 1914-1918 war, rejoined the firm in 1918. After working in the production control and drawing offices, Mr. Foster was appointed a sales representative in 1924.

Publications & Announcements

INFORMATION on 4-dimethylaminobenzaldehyde, which can now be obtained in pure and technical quantities from British Drug Houses, Poole, Dorset, is contained in a technical information booklet which BDH have published. A full description of the properties of this material are given together with an account of its chemical reactions. Uses and suggested uses are given, which include an intermediate in the preparation of dyestuffs, a growth regulating substance (the 2,4-dichlorophenoxyacetyl hydrazone), a starting material in the formation of pyrrole pigments, an additive in the preparation of photographic emulsions, an antioxidant for mineral oils, and a tuberculostat. A large number of references is included.

THE 'Review of Coal Tar Technology January-June 1955' has been published by the Coal Tar Research Association, Oxford Road, Gomersal, near Leeds. This contains a section on coal tar and coal tar products, and a section on general chemistry and chemical techniques relating to coal tar. All the articles are well referenced and there are good author and subject indexes. The price to non-members is 7s 6d.

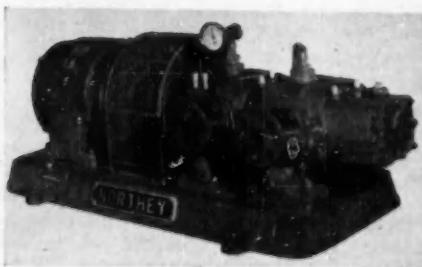
THE removal of scale from heat exchanger and evaporator equipment is very difficult by conventional means, particularly so when both inorganic and organic scale is present. Better results, it is claimed, can be obtained by the use of the Tetrines which are chelating agents supplied by Glyco Products Co. Inc., Empire State Building, New York 1, NY. The calculated amount of the Tetrines is added to a three to five per cent solution of caustic soda or soda ash and the solution circulated through the system at about 200-210°F for two to eight hours depending on the amount of scale present. If the scale is very heavy all may not be removed during the first application. Subsequent treatments should then be made. Regular use of this will, it is said by the company, prevent any further build up of scale and keep the equipment clean without the necessity of shut down.

HYPALON lining is the main feature of a new range of chemical hose recently intro-

duced by William Warne & Co. Ltd. of Barking, Essex. Laboratory and practical tests, claim the company, have proved the hose to be tough and resilient when used for conveying sulphuric acid in concentrations up to 98 per cent, hypochlorites, chromic acid, hydrogen peroxide, and other strong oxidizing agents.

* * *

NORTHEY Rotary Compressors Ltd. have produced a low-pressure oil-free rotary compressor which has two balanced rotors geared together by an external gear to maintain synchronism. There are no inlet or exhaust valves and the air flow is governed by the movement of the rotors past two quadrant shaped ports in the end covers.



The new Northey low-pressure compressor

Apart from the gearing which couples the two balanced rotors, there is no frictional contact at any part of the operating cycle, and maintenance costs are thus reduced to a minimum. No lubricant is necessary in the compression chamber, and the machine is thereafter ideal for use in industries where oil-free air is an essential requirement. However, oil may be used where there is no technical objection, and this does tend to increase the volumetric and seal efficiency.

* * *

SOME new entries in the catalogue of British Drug Houses, Poole, Dorset, have recently been published. A short description is given of the material in each case together with some possible uses, with references where appropriate. The new entries are: 1-bromo-octadecane, penta-chlorophenol, potassium manganate, isopropyl

nitrate, colloidal powder silica, sodium borohydride and sodium thioglycollate.

* * *

THE 1956 edition of the booklet, 'Physical Properties of Synthetic Organic Chemicals' has just been issued by Carbide & Carbon Chemicals Co., a division of Union Carbide & Carbon Corporation. This booklet is prepared annually as a guide for chemists, engineers, purchasing agents, and laboratory workers. This 24-page edition features 32 new products available from Carbide & Carbon. It presents the latest data on more than 350 organic chemicals. The products are arranged by related groups with condensed data on applications. Physical properties are given in tabular form, and an alphabetical index is included for easy reference. Copies of the booklet (F-6136) are available on request from Carbide & Carbon Chemicals Co., 30 East 42nd Street, New York 17, New York.

* * *

DESIGNERS of chemical plant, and chemical and food manufacturers who may be considering using aluminium but who are not sure of its suitability for specific applications will find a lot of useful information in 'Aluminium With Food & Chemicals' a 90-page booklet just published by the Northern Aluminium Co. Ltd. of Banbury, Oxon. The booklet lists the reactions of aluminium with over 500 common chemical and food substances, and contains two chapters on aluminium alloys and the measures that can be taken to prevent or mitigate any attack that might take place. In the two final chapters the types of attack on aluminium, and the decorative and protective measures which can be taken are discussed.

* * *

'RADIO Isotope Instrumentation and Accessories' is the title of a brochure published by the Scientific Instrument Manufacturers' Association of Great Britain Ltd., Queen Anne Street, London W1. 'The purpose of this brochure', says the forward, 'is to assist the potential user of radioactive isotopes in selecting electronic equipment to suit his special needs.' Graphic and tabular data which should be useful to the user of nucleonic instruments are included, but the greater part of the volume is taken up with manufacturers' announcements. In all 44 manufacturers are represented but lack of space prevents a complete list being given of all these companies' products.

TWO short articles describing the nuclear activities of Foster Wheeler Corporation, New York, appear in the July-August issue of *Heat Engineering*, published by the corporation. The first article describes a one megawatt research reactor and associated building to be built at Livermore, California. The corporation has been awarded a contract by the Atomic Energy Commission for the design, construction and test operation of this reactor. Designated as the 'Livermore Pool Type', the reactor will be used by the University of California Radiation Laboratory for the research programme it conducts under contract to the Atomic Energy Commission at the Livermore site. It is scheduled to be in operation by December 1956. One of the modifications in this reactor is a reduction of the volume of water in the pool. This makes for better utilization of experimental facilities. The second article describes the three dimensional schematic model of the aqueous homogeneous power breeder recently offered to the utility industry by Foster Wheeler for the generation of low-cost nuclear electric power. This model was exhibited for the first time at the international exhibition of the peaceful uses of atomic energy, Geneva, in August.

* * *

A CIRCULAR and a dictionary designed to assist the scientist, businessman and layman to understand the different colour vocabularies used in the many fields of art, science and industry have been published by the National Bureau of Standards, US Department of Commerce, Washington 25, DC. The dictionary serves not only as a record of the meanings of the 7,500 individual colour names listed but also enables anyone to translate from one colour to another. The terms by which the dictionary defines colour are a refinement of the method of designating colours outlined by the Inter-Society Colour Council (ISCC) and developed at the National Bureau of Standards. The system applies not only to drugs or chemicals for which it was developed, but to the colours of all opaque, clear, cloudy or fluorescent samples, whether viewed by reflected or transmitted light, and to microscopic structures. The titles of these two publications are: 'The ICSS-NBS Method of Designating Colours' and 'Dictionary of Colour Names', and the combined price is \$2.00 plus postage.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages & Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary but such total may have been reduced.)

PLYSU PRODUCTS LTD., Woburn Sands, plastics etc.—17 November, £1,750 charge, to Miss C. M. Bull, Newport Pagnell; charged on Woodfield, Weathercock Lane, Woburn Sands. *£11,060. 23 December, 1954.

R. HOVENDEN & SONS LTD., London W, chemical manufacturers etc.—11 November, £50,000 mortgaged to Alliance Building Society; charged on leasehold 29, 30, 31 & 32 Berners Street W1. *Nil. 6 July, 1955.

RICHARD WILSON & SON LTD., Bury, fertilizer manufacturers etc.—14 November, debentured to District Bank Ltd. securing all moneys due or to become due to the bank; general charge.

Receiverships

FRIGONIA LTD., manufacturers of chemicals & chemical preparations etc. 16 Great Western Road, Paddington, London W9. Mr. Walter Love, 10 Sutherland Avenue, London W9, was appointed Receiver on 16 November 1955, under powers contained in deposit of deeds dated 18 January, 1952.

Satisfaction

BRITISH CELANESE LTD., London W.—Satisfaction, 24 November, of debentured stock and supplemental deed respectively registered 2 October, 1943, and 8 November, 1944, to the extent of £3,135.

Changes of Name

PRODUCTS DEVELOPMENT LTD., 22-23 Hanover Square, London W1, changed to Celanese Plastics Textiles & Chemicals Ltd., on 11 November, 1955.

J. H. DYSON & SON LTD., manufacturers of soap etc., Waterside, Halifax, Yorks, changed to J.H.D. Ltd., on 4 November,

Increases of Capital

BRITISH CARBO NORIT UNION LTD., increased by £22,500, in 900,000 ordinary shares of 6d each, beyond the registered capital of £12,500.

LYNEX LTD., drug merchants etc., 68 Clevedon Road, Balsall Heath, Birmingham 12, increased by £1,500, in £1 ordinary shares, beyond the registered capital of £1,000.

F. W. BERK & CO. LTD., chemical manufacturers, merchants etc., 1-19 New Oxford Street, London WC1, increased by £480,000, in 5s. ordinary shares, beyond the registered capital of £1,000,000.

JOHN DALE LTD., Brunswick Park Road, New Southgate, London N11, increased by £100,000, in 5s. ordinary shares, beyond the registered capital of £600,000.

JAMES M. BROWN LTD., manufacturers of chemical, metallurgical and other products etc., 14 Waterloo Place, London SW1, increased by £150,000, in £1 unclassified shares, beyond the registered capital of £50,000.

MERCK-SHARP & DOHME LTD. (formerly Sharpe & Dohme Ltd.), chemists, druggists etc., West Hill, Hertford Road, Hoddesdon, Herts, increased by £181,200, in £1 ordinary shares, beyond the registered capital of £45,300.

UTILEX LTD., manufacturers of viscose and cellulose acetate products, plastics, wrapping materials, gramophone records, safety glass etc., Mill Street, Kingston-on-Thames, Surrey, increased by £26,600, in £1 ordinary shares, beyond the registered capital of £13,300.

WILFRID SMITH LTD., chemical merchants, manufacturers of and dealers in raw rubber, reclaimed rubber etc., 16 Philpot Lane, London EC3, increased by £25,000, in £1 ordinary shares, beyond the registered capital of £25,000.

J. BIBBY & SONS LTD., 21 King Edward Street, Liverpool 3, increased by £3,750,000, in 1,250,000 six per cent cumulative preference, 2,000,000 ordinary and 500,000 cumu-

lative preference shares of £1 each, beyond the registered capital of £2,750,000.

J. H. DYSON & SON LTD., soap manufacturers etc., Waterside Soap Works, Halifax, increased by £14,900, in £1 ordinary shares,

manufacturers and sellers of ethical and non-ethical medicines, drugs, preparations and appliances etc. Subscribers: Mrs. H. L. Price-Graham and Jack S. Belton, Solicitors: J. F. W. Harrison, 88 High Street, Hoddesdon, Herts.

New Registrations

Gel Tankers Ltd.

Private company (557,841.) Capital £100 in £1 shares. To carry on the business of carriers by land, sea and air, owners and operators of ships, motors, wagons and in particular tanks, tankers, pumping stations, pipe lines and any other works to carry or store petroleum, chemicals, oils, liquids etc. Subscribers: Gel Chemicals Ltd., 11 Ironmonger Lane, London EC2, and John R. B. Maitland. Directors: John R. B. Maitland, Tudor Barn, Cookham Dean, Berks, and Edmund A. E. Nicholls-Roth, Mining Club, 3 London Wall Buildings, London EC2.

Jeyes-Ibco Sales Ltd.

Private company (557,748.) Capital £100 in £1 shares. To carry on the business of manufacturers of and dealers in sanitary products of all kinds etc. Subscribers: Jean L. Coxon and Sheila M. A. Bent. The first directors are to be appointed by the subscribers. Reg. office: River Road, Barking, Essex.

Hanbury Chemicals Ltd.

Private company (557,777.) Capital £1,000 in £1 shares. Directors: Gerald D. I. Rushton and Dorothy Rushton. Reg. office: Hanbury Works, Stoke Prior, Bromsgrove, Worcs.

Vepal (Laboratories) Ltd.

Private company (557,867.) Capital £100 in £1 shares. To carry on the business of

CFD Ltd.

Private company. (15,802). Registered in Dublin. Capital £40,000 in 10,000 employees shares and 30,000 ordinary shares of £1. To carry on business as manufacturers, importers and exporters of and wholesale and retail dealers in fertilizers, artificial manures, chemicals, farm, dairy and milling requisites etc. Directors: Henry N. Wolfe, Ilfracombe, Cork; Leslie S. Atkins, B.A., B.Sc., Andreas, Rosebank Park, Cork; Joseph A. Wolfe, Cork; E. F. Storey and Michael J. Richardson.

Walter F. Pickup Ltd.

Private company. (557,555). Capital £100 in £1 shares. To carry on the business of manufacturing chemists etc. Subscribers: John R. Norris, Victor E. Coleman and Walter F. Pickup. Registered office: 18 Maddox Street, London W1.

Company News

British Alkaloids Ltd.

Shareholders of British Alkaloids Ltd., manufacturing chemists of London, have approved the increase in authorized capital and the capitalization of reserves.

Courtaulds (Australia) Ltd.

Courtaulds (Australia) Ltd. recorded a profit of £A111,117 in the year ended 30 June 1955, as against a loss of £A190,123 in the previous year. Because of the increased competition from imported textile

[continued on page 1386]

Manufacturers' Agents for:

Importers of Produce from:

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Britain's Atomic Factories



The whole of the pipework in the highly and medium radio-active areas on the primary separation plant and vessels in the highly active section of Britain's Atomic Factories were fabricated in stainless steel and installed by Ashmore, Benson, Pease & Company. Using many welding sets, in conjunction with Argon arc sets, Ashmore's installed over ten miles of pipework with 40,000 butt-welded pipe joints and completed five miles of plate and sheet welding. Twenty-five X-ray sets were employed and extensive use made of radio-active isotopes. Approximately 60,000 radiographs were filed.

**THE POWER-GAS CORPORATION LIMITED
AND
ASHMORE, BENSON, PEASE & COMPANY**

STOCKTON-ON-TEES AND LONDON

AUSTRALIA • CANADA • FRANCE • INDIA • SOUTH AFRICA

Company News

continued from page 1384]

yarn, demand for the company's acetate yarn fell below the production capacity. The result of a Tariff Board inquiry into the acetate yarn situation has not yet been announced, but if a favourable tariff is granted the company considers this section of its business would show a profit. During the year the output of viscose yarn was affected by delays in deliveries of raw materials.

Palestine Potash

It is proposed to reduce the £1,000,000 issued capital of Palestine Potash to £629,500 by repaying 19s per £1 preference. The directors of the company, whose chief asset is an investment in Dead Sea Works, consider that the present structure of the company is not such as to enable shareholders to obtain the maximum benefits from resources. The repayment will be satisfied by the transfer from the company of one £1 nominal of five per cent debenture stock and one 'B' founders share of £1 in Dead Sea Works for each preference share. Extra-ordinary and annual meeting of the company will be held at 4 Copthall Avenue, London EC2, on 11 January.

Anglo-Lautaro Nitrate

A construction programme planned in the year ended 30 June, which was to cost \$4,000,000, had to be curtailed owing to an unexpected delay in ratification of the contract by the American Congress. Net profit for the year was \$3,715,718 compared with \$2,062,312 for the previous year and the dividend on the 'A' shares was raised from 50 cents to 80 cents. The directors say that earnings are 'completely inadequate' when measured in terms of the company's investment replacement, value of properties and future capital requirements. The company meeting will be held in Santiago, 30 December.

Cheshire United Salt Co.

Sales have been satisfactory and again show an increase over the previous year says the director's report for the year ending 30 June of the Cheshire United Salt Co. The consolidated net profit for the year was £83,967 compared with £77,154 for the previous year. However, manufacturing and trading profits were somewhat lower. More salt was produced and sold but increased costs which had not been passed

on to the consumer had narrowed profit margins. The general reserve has been increased to £45,000 by the transfer of £15,000 from profits. The balance of profits carried forward was £54,958. A final ordinary dividend of 6 per cent less tax will be paid to ordinary shareholders making 10 per cent for the year, together with a bonus of 2½ per cent actual.

Market Reports

LONDON.—Quieter conditions have prevailed on the chemical markets during the past week, but trading is not less active than is customary just before the Christmas holiday. There has been a fair interest in new bookings covering deliveries over the first half of 1956, but a return to an active demand is not likely to be in evidence until the New Year. Prices generally are unchanged with a firm undertone. Among the tar products, creosote oil continues in steady request and there is a moderate call for the light distillates. Cresylic acid prices increase on 1 January, the pale 99/100 per cent will be 6s 4d per gallon and the 99½/100 per cent 6s 6d per gallon.

MANCHESTER.—A fairly steady demand has been reported on the Manchester chemical market during the past week for the alkalis and the potash and ammonia compounds, as well as for a wide range of other products, although as usual at this time of the year the pressure for deliveries is less pronounced due to stocktaking and other seasonal influences. Prices generally are firm, especially in the non-ferrous metal products. A moderate business continues to be done in fertilizers, with basic slag a busy section. Most of the light and heavy tar products have been in steady demand.

GLASGOW.—An extremely busy week has been experienced in the Scottish heavy chemical market and business in most sections of the industry has shown improvement. Orders received covered both prompt and forward delivery. Inquiries and the placing of contracts for next year's supplies are now very much in evidence. Prices continue to remain fairly steady. On the export side a favourable position has again to be reported with a continued volume of inquiries being received.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

BORAX CONSOLIDATED LIMITED
invite applications from CHEMISTS, age 22-30, who are University Graduates in Chemistry or equivalent qualifications for Technical Sales Development at their head office near Victoria Station. The work is of an advisory nature, interesting and involves some liaison with industry. Previous experience unnecessary. Excellent prospects for ambitious young man. Non-contributory pension, lunches, etc. Apply in writing, to Staff Manager, Borax House, Carlisle Place, London, S.W.1.

GRADUATE in Chemistry required for important research and development work on resins and polymers. Some experience in research methods is preferable but not essential. The post offers scope and good prospects. Old established Company situated in Lancashire. Salary commensurate with age and experience. A Superannuation Scheme is in operation. Applicants are requested to apply to **BOX NO. C.A. 3448, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

CHEMIST

required for Analytical and Preparative Research on Inorganic Chemicals and Magnesium Alloys.

Applicants should have B.Sc. or A.R.I.C. with some practical experience and would be expected to work under the Chief Analyst in a modern and well-equipped Laboratory.

Salary depending on qualification and experience.

Pension and Life Assurance.

Please apply, stating Reference C.A. D7, age, details of qualifications and experience, to:

**PERSONNEL OFFICER (STAFF),
MAGNESIUM ELEKTRON, LIMITED,
P.O. BOX No. 6,
LUMM'S LANE, CLIFTON JUNCTION,
SWINTON, NR. MANCHESTER.**

MECHANICAL AND CHEMICAL ENGINEERS
COURTAULDS, LIMITED,

Chemical Division,

requires a Graduate Mechanical Engineer and a Chemical Engineer for investigational and development work near Manchester.

The work is of an original nature in connection with the development of chemical plants and processes for which a real interest in, and potential talent for, engineering development work as applied to large-scale chemical plant is of paramount importance. The Mechanical Engineer must have served an apprenticeship for at least two years and all candidates must have had practical working experience. Honours Degree men preferred. Age 25 to 35.

Candidates should write for a detailed form of application to:

**THE DIRECTOR OF PERSONNEL,
COURTAULDS, LIMITED,**

16, ST. MARTINS-LE-GRAND, LONDON, E.C.1,
quoting the Reference H.10 for the Mechanical Engineer and H.11 for the Chemical Engineer.

CHEMICAL BUYER. Knowledge industrial and pharmaceutical chemical sources of supply and export work an advantage. Good prospects. Salary according to experience. Pension Scheme and Provident Fund. Apply to **BOX NO. C.A. 3449, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

CHEMIST. experienced in manufacture of pigments. Salary, £750-£1,000 a year plus commission on profits and eventual directorship if satisfactory. Apply **WESSEL, LTD., BOX 26, G.P.O., DOUGLAS, ISLE OF MAN.**

ENGINEER required for an interesting post involving investigations into the expansion and development of all services, except electrical, within a large factory. University Degree's applicants preferred, but good practical experience and membership of the Institution of Mechanical Engineers, Chemical Engineers or Heating and Ventilating Engineers would merit serious consideration. For the right person the starting salary will be in keeping with the remuneration possible to engineers at the present time and will be subject to annual review. Brief particulars of relevant information regarding experience and career, to be given with application. Maximum age around 35. Applications to **BOX NO. C.A. 3450, THE CHEMICAL AGE, 154, FLEET STREET, LONDON, E.C.4.**

GRADUATES in **MECHANICAL** and **CHEMICAL ENGINEERING** required for progressive positions in the Research, Design and Production Divisions of **THE POWER-GAS CORPORATION LIMITED**. Training given to men without previous industrial experience. Apply to: **STAFF PERSONNEL MANAGER, PARKFIELD WORKS, STOCKTON-ON-TEES.**

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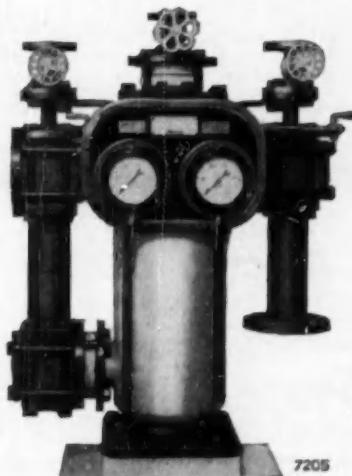
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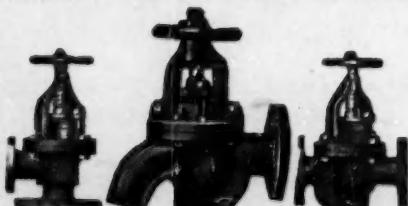
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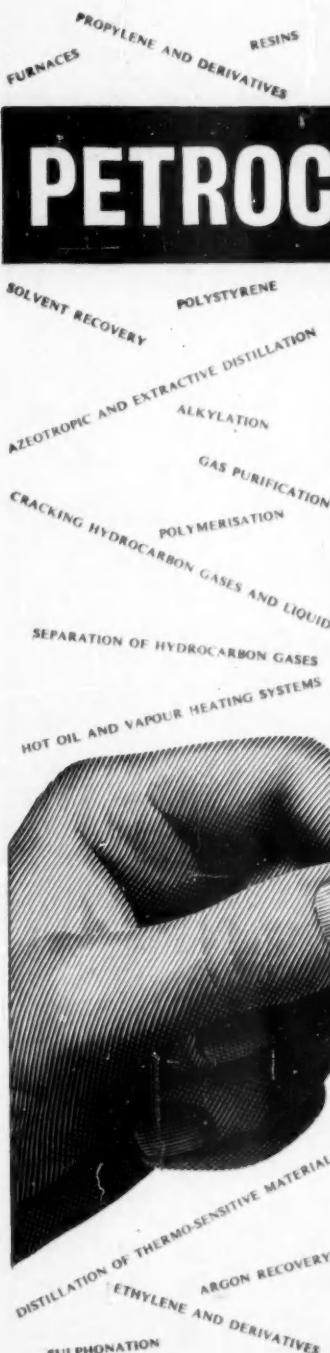
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